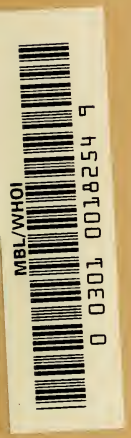
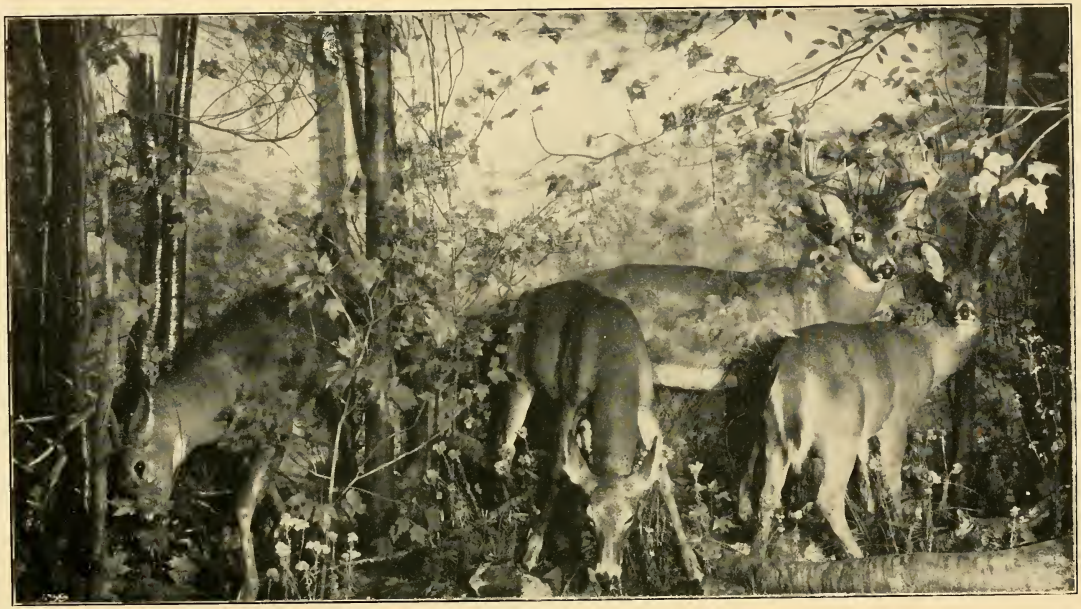
THE MAMMALS
of
PENNSYLVANIA

with the compliments
of the author.
S.H.W.





VIRGINIA WHITE TAILED DEER *Odocoileus virginianus virginianus*

Courtesy Carnegie Museum

The
MAMMALS OF PENNSYLVANIA

With a Discussion of the Biology of Mammals in General, including Keys to the Orders and Families, and with Detailed Accounts of All Species Indigenous to Pennsylvania. Fully Illustrated.

by

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PITTSBURGH - 1928

To

REMI H. SANTENS

whose skill in the art of Taxidermy has done much to further public interest in Natural History, this volume is gratefully dedicated.

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PREFACE

FOR a number of years, the writer has felt the need of a work that deals specifically with the Mammals native to the State of Pennsylvania. This little Handbook is designed for Boy Scouts, Hunters and Sportsmen, Nature Study students and teachers, and for all lovers of the great outdoors.

An attempt has been made to include all of the material that the student of mammals needs for a proper appreciation of the animal world. In order to include the discussions of the Biology of Mammals, it has been necessary to reduce all of these to an absolute minimum, so that the volume might be kept within a practicable size. In many cases only the interesting possibilities of the various phases of Mammalian study have been stressed. The inclusion of many known facts in these cases would add too much volume for a work of this kind. Then, too, the student would be robbed of making many interesting discoveries "on his own."

It is the hope of the writer that all those for whom this book is intended will find it practical and stimulating.

The writer is indebted to his colleagues in the Zoology Department for many helpful suggestions and constructive criticisms. Grateful acknowledgment is due Dr. Andrey Avinoff and the other officials of the Carnegie Museum for permission to use photographs

of various animal groups, and for placing their collections at the writer's disposal for photographing and studying. Mr. R. L. Fricke, of the Carnegie Museum, supplied the photographs of Bonaparte's Weasel and the Big Brown Bat. The drawings of animal tracks were made by Miss Ruth Isensee, under the direction of the author.

The author wishes to thank Dr. H. T. H. Jackson and his colleagues, in the Bureau of the United States Biological Survey, for the photographs of the Common and the Star Nosed Moles.

Mr. Remi H. Santens, Chief Taxidermist in the Carnegie Museum and Instructor of Taxidermy in the Zoology Department, has made possible the excellent phototgraphs, which were taken by Mr. W. S. Coffman, under the direction of the author. Mr. Geo. W. Gordon, with whom the writer has, for many years, observed the wild creatures in their native haunts, has been quite helpful in many ways.

While all of these associates have been of great assistance, the author assumes the entire responsibility for any errors that have doubtless crept into this work.

The General Characters of Mammals

The mammals belong to the group of the animal kingdom known as Vertebrates. These are distinguished by the fact that they possess a Vertebral Column or Backbone. The group includes the Fishes, Amphibians, Reptiles, Birds and Mammals. However, the mammals differ from the others in two important respects; in the first place, the mammals are the only animals that possess a coating of hair; secondly, the young of mammals are nourished by secretions extracted from the body of the mother through the mammary glands which lead to the exterior through the nipples located on the ventral surface of the body.

All mammals are warm blooded and, although certain forms like the Whales, Seals and Dolphins are adapted to living in the water, all are air-breathing. With only two exceptions, the mammals are all viviparous; that is, they bring forth their young alive. The exceptions are the Australian Duck-billed Mole *Ornithorhyncus paradoxus* and the Spiny Anteater *Echidna.* Both of these forms are strikingly unique in that they retain the primitive habit of laying eggs, as do birds and reptiles. When the eggs hatch, the young are taken by the mother and nourished in the usual way. However, these two forms do not have well developed mammae and mammary glands. The milk in this case is secreted by modified sweat glands and exudes through pores located on the ventral surface of the body. It is then licked off by the young animals.

There are other animals which bear living young, however. This is true of certain snakes, such as the

common rattle snake, but among mammals the young are usually attached to the mother by a placenta and an umbilical cord, although the Marsupials which bear their young prematurely lack this cord.

In size, the mammals range from a small Shrew *(Crocidura)** of Madagascar, which is less than three inches long, to the massive Rorqual Whale *(Balaeonaptera Sibbaldii* Gray) of the North Atlantic, which sometimes attains a length of 85 feet. The smallest American mammal is a shrew *Microsorex winnemana,* which is about three inches long. The home of this animal is Virginia.

At the present time there are between 3500 and 4000 mammals known to Science. Of this number about 1300 are known to inhabit North America. In Pennsylvania, the group is represented by about sixty species and subspecies. Formerly there were many others, but the advent of civilization has reduced their numbers.

Without wishing to introduce a technical obstacle to interest in this treatise, the author feels that a brief discussion of Biological Principles is in place.

The History of Mammals

While it would be utterly impossible to incorporate in this discourse a detailed discussion of mammalian development, it might be well to indicate some of the factors that have contributed to the rise of such a diverse group.

It must be remembered that the animals on the face of the earth today are the descendants of less

* Henn, A. W. "The Range of Size in the Vertebrates." Amer. Nat., March, 1912.

specialized forms that existed millions of years ago. This evolution, or development, has proceeded slowly and is the result of a combination of Biological and Physical factors. Certainly, Natural Selection, physiological and physical adaptations to food and temperature, moisture, and topographical variations, have played an obvious part.

The mammals are the most recently developed group in the animal world. Moreover, their development has been remarkably rapid when it is contrasted with the development of many other forms. After the other Vertebrates (Fishes, Amphibians and Reptiles) had failed, in succession, to maintain the supremacy of the world, the mammals with a keener intelligence, which brought with it parental care, have advanced to a position which is more or less dominant.

Although there is still some difference of opinion regarding the origin of mammals, the evidence seems to point to reptilian ancestors. Fossil remains of extinct, dog-toothed reptiles in the Triassic rocks of South Africa, appear to possess structures which suggest that present day mammals and those that preceded them were, more or less, directly descended from reptilian forms.

As has been shown in every animal group that has attained a high degree of specialization, the mammals have undergone a progressive development from simpler ancestral forms. The earliest known mammals appear to have been of a very small size, arboreal and insectivorous in their habits. A small Tree Shrew, living in Africa, is thought to more closely represent the earliest placental mammals than any other living creature.

To properly comprehend and appreciate mammals and their relation to the past, it is necessary to become acquainted with the salient facts of Paleontology, Embryology, Anatomy, and Geographical Distribution. The word development or "Evolution" implies change and, since the changes are so slow as to be imperceptible, it is not easy for the uninformed individual to comprehend the changes that have, and are still, taking place, or, to understand the effects of these changes upon existing life.

The mammal has its origin in the form of a fertilized egg which develops into an Embryo within the body of the mother. The embryo remains within the body and undergoes a further development until the new animal has attained all of its organs and structures and until all of the vital processes are differentiated. The length of time for this development within the mother depends upon the kind of animal, varying from three weeks in the rat to almost two years in the elephant.

As the embryo develops, it passes through an interesting series of stages which show, to a remarkable degree, the stages through which the whole race has passed. This embryological development coincides pretty well with the Paleontological evidence, or the fossil records of the evolution of living things.

The Student of mammals will soon observe that there is a unique distribution of animals over the face of the earth. While it is obvious that the faunas of the various continents are characteristic of those continents, it is also just as obvious that many animal groups in continents which are somewhat removed from one another, are similar in many respects. How may we account for these relationships?

The study of Geology indicates that at some time, in the early history of the world, these continents were more or less directly connected by continental bridges. By means of these land connections, which made these continents contiguous, it was possible for air-breathing forms to migrate from one continent to another. Consequent Geological changes isolated certain of these continents, while on the other hand, land areas that were formerly more or less isolated were connected through the shifting of the oceans. Combined with these changes in land and water areas were constant variations of climatic conditions, such as were produced through the movement of glaciers and through the elevation and lowering of land areas by upheaval. The existing animal forms were, therefore, forced to endure new and ever-changing conditions and, in the process of evolution and adaptation, a multitude of kinds resulted.

As is to be expected, many animals were unable to meet the situation and, failing in their Biotic response to the new environment, they perished. Others which could migrate, probably did so, while still others were forced to modify their structures and habits of living.

These conditions, ofttimes changing from a warm climate, with its associated abundance of a particular vegetation, to a comparatively frigid one, necessitated either adaptation or migration. When certain forms could do neither, they passed from the living picture and became extinct. Others were able to move from unfavorable situations and today we see their descendants holding forth in a tropical setting which, although somewhat modified, is similar in many respects to that of their predecessors. Others met the new demands

by modification of food and body structures. Thus these rapidly changing conditions forced an accelerated and diversified development of the mammals.

Evidence of these changes in America are numerous. The tragedies revealed in the investigations of the pitch lakes at Rancho LaBrea in southern California, in which the skeletal remains of the Saber-toothed Tiger and hundreds of other forms no longer existent have been found, and the discovery of fossil Dinosaurs in Wyoming, are indubitable records of these Geological and attendant climatic transitions.

We have reason to believe that, millions of years ago, the region between the Allegheny and Rocky Mountains was the bed of a gigantic ocean which later shifted its basin, leaving in its wake, a series of lakes, ponds, streams and swamps, many of which were later drained or dried up. The available land areas were immediately claimed by a luxurious growth of vegetation with which there became associated an interesting fauna. The fossil remains of the plants and animals of that time indicate that the climate was of a tropical or subtropical character.

Far in the North the long winters were producing quantities of snow and ice which the comparatively short summers could not melt. The accumulated mass grew to gigantic proportions and later covered the whole northern part of this continent. Then this great ice sheet began to move southward. Naturally, as it descended, it brought about a very pronounced change in temperature. This ice sheet, or glacier, which probably attained a height of two miles in some places moved across the northern part of New York and the northern and northwestern part of Pennsylvania, its

sides extending southward to what is now the dividing line between Butler and Mercer counties. The terminus of the glacier was in the region now known as the Beaver Valley.

As the mass of ice moved across the surface of the ground, its tremendous weight caused it to push thousands of tons of soil before it. Great quantities of rock and other soil material were gathered in its movement and these added to its abrasive surface. The cutting and grinding of this great mass of ice certainly left indelible marks on the landscape over which it passed.

When the ice began to melt, the soil material at the terminus and along the sides was deposited. The material was left in great bank-like formations called Moraines. As one travels from Butler to Grove City, he passes over the lateral moraine and suddenly emerges from the "flat stone country" of the south into the "round stone country," which marks the glacier's path. In these moraines are to be found the fossil remains of Corals, Crinoids and other marine animals that were evidently transported from deposits in Northern New York, where the upper Devonian rocks are nearer the surface.

The great quantities of water resulting from the melting ice, having an insufficient outlet, backed up the Ohio Valley and formed a large lake in what is now the city of Pittsburgh. That the whole previous drainage system of this region was changed, is shown by excavations in the Schenley District of Pittsburgh. Below the soil deposited by the glacial lake there is revealed the pre-glacial gravel which marks the former bed of the Monongahela River. Prior to the coming of the glacier, the waters for some distance south of

Erie flowed northward, but, since the recession of the glacier, they flow southward into the Ohio river drainage system. The Great Lakes were also formed by the movement and subsequent disappearance of the glacier.

Other evidences of changes that have taken place in Pennsylvania may be briefly cited. On the summits of Laurel and Chestnut Ridges of the Allegheny Mountains one can find many limestone quarries in which there are the remains of thousands of Brachiopods and other marine Mollusks, which indicate the former limits of the Atlantic Ocean.

In the shales associated with the bituminous coal beds of the state, in limestone deposits, and scattered about near the surface of the ground, one can see perfectly formed fossil remains of plants that no longer exist, such as Tree Ferns, small flowering plants, Calamites, and the striking forms of Lepidodendrons and Sigillarids. These latter plants were of endogenous character and grew to heights of over one hundred feet. Their petrified sections are often mistaken for fossil fishes and snakes. These remnants of extinct forms indicate that another order existed in times long past.

In Jefferson County, near Brookville, the fossil remains of giant cockroaches, which were evidently once abundant, have been found. It is reasonable to assume that the mammals which were slowly developing at the time these forms existed were affected by the radical changes in topography and climate.

The fossil beds of Pennsylvania have yielded the remains of Whales, Dolphins, Horses, Elephants, Peccaries, Tapirs and many other pre-historic animal species. All of these testify to the principle of everlasting change.

To demonstrate that the changes mentioned above have not ceased altogether, and to show that, at present times, changes of a very marked character are still being effected, it is necessary only to point out the fact that the level of Lake Erie is continually falling. The old shore lines, which indicate the former limits of the lake, are to be seen for many miles from the present water margins. Presque Isle, a peninsula extending into the lake at Erie, has been moving eastward for over six hundred years and it is still in a state of continuous motion and change.

On this peninsula old ponds are disappearing while new ponds are being formed. The whole contour of the peninsula, which is now a state park, is so rapidly changing that these changes may be noted from year to year.

Both the Atlantic and Pacific coasts are likewise showing a constant variation. Shore lines are advancing at certain points and receding at others. Thus, we see that the old hymn, "Change and Decay In All Around I See," is an expression of reality.

The Science of Ecology, or the study of organism and their relation to the environment, has shown that there is a definite relationship between an animal and the conditions under which it lives. In fact, it is the environment which largely determines the animal association to be found in a given place. The significance of this is emphasized by observing specialized adaptations to water; to burrowing in the ground; to arboreal existence, etc. If any one of these conditions were to be suddenly removed, the animals mostly highly specialized to it would perish. If conditions were to change gradually the weaker ones would probably perish, but

the stronger ones would continue to live under stressing conditions which would undoubtedly result in changes in them after a sufficient number of generations. Naturally all of these modifications bring about a change in the distribution of animal forms. The movement of soil from the north, by the glacier, made conditions favorable for the southward migration of northerly plants and animals, and we find many things, notably plants and insects in northwestern Pennsylvania, that are not to be found elsewhere in the state.

Other factors also affect the distribution of life. Nature has established barriers to migration in the forms of mountains, lakes, oceans, etc., over which some forms can not pass. The fauna west of the Rocky Mountains, for instance, differs from that of the eastern slope, because many creatures can not negotiate the great heights. Even the birds, which are better equipped for migration than most other forms, have found the mountains to be an impassable barrier and only a few of them are able to fly across. On the other hand, wind, rivers and water gaps are natural highways over which the distribution of life is facilitated.

Distribution within a limited area, such as in the state of Pennsylvania under modern conditions, is a rather artificial thing. The result of dissemination, through common carriers and through the activities of humans themselves, is rapidly being felt, particularly in respect to destructive organisms. Deforestation, industrialization and the tendency toward the population of all available land areas, has had, and will continue to have, a pronounced effect upon the distribution of wild life. All of these factors tend to upset the balance of Nature and to reduce the numbers of wild creatures.

Unfortunately, the only attempt to study the mammalian life zones of Pennsylvania was made twenty-five years ago (Rhoads 1903) and, undoubtedly, the distribution is somewhat altered at the present time. It is well known that some animals are fairly well distributed over the state, while others are confined to comparatively narrow limits. There are numerous factors which explain both the general and specific localities of various mammalian forms. Undoubtedly, the mountains have previously proved an effective barrier to many forms, but the opening of highways has altered their effectiveness to some extent. On the other hand, the mountains provide a more suitable set of conditions for some animals that are to be found only within their confines. The great variety of conditions that obtain within the Commonwealth yield an interesting fauna.

The foregoing sketchy account of some of the factors that contribute to the diversification and distribution of animal groups is given only to indicate the breadth of Mammalian study. It is hoped that these scattered suggestions and illustrations will stimulate the intellectual curiosity of the reader and arouse in him an aggressive interest. Further details would add too much volume to this treatise and thus destroy the purpose of the writer. The Classified Bibliography contains a sufficient number of both general and specific works for ordinary purposes.

The Hair of Mammals

With a few exceptions such as Whales, Dolphins, etc., the mammals are covered with a coating of hair of varying length and thickness according to the spec-

ies. There are two kinds of hair on a mammal: (1) the long, coarse, over-hair which is chiefly protective, and (2) the fine, soft, underfur, which serves to preserve a normal body temperature. There are also highly specialized hairs, (vibrissae) which are sensory. The "whiskers" located on the face, and the coarse hairs often found above the eyes and on the wrist near the hand, are evidently sensory and aid the senses of smell, touch and hearing.

The primary purpose of the hair coat is protective. This protection is effected in two ways. In the first place, insulation against low temperatures seems paramount, and secondly, a heavy coat of hair affords protection from serious injury by the teeth of other animals and sheds water, thus preventing the body of the animal from getting wet. Some mammals are born with a fine, silken coat of hair, while others are born hairless. The latter are kept warm by contact with the mother, or by being cuddled together in a well lined nest. These forms are usually born in warm seasons or are produced in deep burrows.

No single description could account for all of the changes that take place in the hair growth of mammals in general and there are considerable differences among the types of hair of infancy, youth and maturity, that of an adult usually being coarser. The distribution of the hair over the body is also variable according to the kind of mammal, but it is generally longer and more dense on the dorsal surface of the body. On virtually all forms there are sections of the body which are devoid of hair, such as under the hind legs, around the mammae, etc.

The length and density of the hair are also regulated by the seasons and mammals are known to have longer and heavier coats in winter than in summer. In the Spring there is a shedding or moult of surplus hair, in some forms there is also another moult in the Fall, then the winter coat begins to develop and, by the first snowfall, the creatures are prepared to withstand wintery blasts. The shaggy coats of horses and cattle in the winter are familiar to everyone and are characteristic of Nature's method of supplying additional warmth. Trappers always secure skins for commercial purposes in the winter.

The Color and Color Patterns of Mammals

The average person identifies an animal by its size, shape and color. While there are a few mammals that have brilliant colors, they are, as a rule, less gaudy than birds and many other animals.

Most mammals have a very definite color pattern which is more or less constant. However, there are considerable variations in the pattern and in the color intensity within a species. For instance, one Red Fox may be considerably duller than another. In a number of mammals, the young differ widely from mature individuals. Occasionally Albinos appear. In these there is a little or no trace of pigmentation and the animals are white or nearly so. Usually Albinos have pink eyes due to the fact that there is no pigment to conceal the mass of small blood vessels present, and these are responsible for the characteristic tint. Albinism is an hereditary character and appears in most Mammalian groups. Thus we occasionally see white blackbirds, white crows, white ground hogs, white

deer, and even white bats are not uncommon. Sometimes the change of coloration is due to disease or improper food.

The formation of color and the color pattern of animals is still a matter of scientific controversy. The old explanation of the fact that numerous animals have color patterns which harmonize so well with their surroundings as to render them invisible to their enemies, seems to have received a jolt. The accounting for this remarkable phenomenon of protection, as a universal proof of a definite directive force in nature, appears to have been based on assumptions too general in character. With the advance of Physiological experimentation, a number of instances have been shown which seem to disprove the theory in specific cases. As a result of these investigations, some Physiological Ecologists have been rather prone to reject the old idea as a whole, although there are instances in which they can not justfy their positions.

There is no doubt that the colors of many animals lend themselves in a protective way, in that they render the animals invisible against the backgrounds in situations where they exist. A specimen which may appear striking in a Museum case may be practically invisible in its native haunts. That animals are aware of this protection, is not to be doubted. No person who has ever seen a grouse or quail snuggle on its nest among the dead leaves on the ground, or, who has discovered a whip-poor-will resting on a dead log during the day, can doubt that these forms depend, for protection, to a large extent, on the fact that their color patterns harmonize with their surroundings. Certain frogs, lizards and fishes can change their colors to suit the back-

grounds on which they are resting. The well known Chameleon, sold at County Fairs, possesses this faculty.

Colors have ordinarily been placed into two categories: (1) Concealing colors and (2) Warning colors. The purpose of the first is to render the animal invisible or inconspicuous, while the second is supposed to be a sign of ferociousness or formidability, by which other animals are warned to keep away. It is, in other words, a danger sign. Certainly we can not place too much confidence in the old idea of protective coloration, nor can we concede to the claims of certain Physiologists that such a thing does not exist. Modern knowledge of colors shows that they, and the hair itself, are by-products of animal metabolism. Thus the colors of Mammals are definitely dependent upon a number of factors, Physical, Chemical and Physiological. Temperature, food, moisture and especially light, have played their part in color production. While all of these factors show more or less *immediate* effects, it must be remembered that definite color pattern did not originate in a short time, but that its formation is the result of many generations of gradual physiological adaptations. There is thus a phylogenetic or racial factor involved.

Granting that color formation and deposition into a definite pattern is chiefly physiological, insofar as its immediate distribution is concerned, it is significant that the colors of many forms are adaptive. Arctic birds and mammals in their winter dress are white; those of desert regions are usually a dull brownish gray; forest animals are frequently striped; and those of the open plains are nearly uniform in color. Certainly, the snow-white coats of the Varying Hare and

the Weasel in winter, render these animals less visible to their enemies when snow covers the ground.

The study of coloration among existing mammals has led to the conclusion that the primitive pattern consisted of either transverse or longitudinal stripes, and that it was probably the latter. Many mammals have young that are spotted or striped one way or the other, but these stripes and spots disappear as the animal grows older. The striped patterns are generally supposed to have been adapted to forest conditions.

The fact that certain moths invariably rest on trees, against which they are extremely difficult to see, and the fact that many other forms seek the backgrounds against which they are inconspicuous, prompts the writer to be reticent in casting aside the idea of a purposive character in nature. It must be remembered that many other Zoologists are not willing to accept, in its entirety, the theory that all coloration is purely Physiological. There is still considerable evidence of purely protective colors which seem to be the object of a purposive creation.

The Habitats of Mammals

The mammals present a very interesting assortment of preferences in choosing places in which to live and build their homes. Some of them have specially adapted structures which determine the sort of habitats in which they are to be found. Mammals may be classified as Terrestrial, Arboreal, Aquatic and Aerial. Terrestrial animals include those that live on or under the ground. Animals that live in trees are Arboreal; flying animals, such as bats, are Aerial. Those forms like the whales, seals and dolphins, which are structur-

ally adapted to living in water, are Aquatic. The student of Mammalogy will soon observe that each kind of mammal has its own idea of suitable quarters for nesting and foraging, although the lack or abundance of food, together with other factors, will, to an extent, alter its habits of living.

Some mammals, like the meadow mice and rabbits, prefer the open fields; others, like the porcupine and wildcat, choose densely wooded sections; some burrow in the ground, as do moles and woodchucks; while certain kinds, such as the Squirrels, prefer, and are structurally adapted to living in trees. It will be observed that some mammals are more or less solitary in their habits, while others, like the beaver and flying squirrels, often live in colonies.

Raccoons hunt along the shores of ponds and streams and feed upon animals that live in shallow water. On the other hand, the otter and mink do not hesitate to dive into the deeper waters for fish. The beaver and muskrat construct their homes out in the water and are forced to dive in order to secure entrance to them.

Observation will show that the character of the soil, and even the exposure of the land, will frequently determine the animal associations with it. There are some carnivorous animals that have very definite types of situations in which they build their homes, but they are forced into all sorts of localities in the pursuit of food. The fox, for instance, prefers a cave-like retreat for its home, but it wanders over hill and dale, through woods and open fields, in its search for sustenance.

In recording a situation in which a Mammal is observed, the student should list all of the factors that appear in the environment. The Place, County, State and Date, should always be recorded in a Field notebook under the name of the Mammal. The field notes should always indicate whether the animal, its burrow, or its tracks, were observed in the woods, in the thick growth along a fence, or in an open field. The nature of the vegetation should also be noted and records should indicate: grass, low shrubs, trees, ferns, cultivated plants, field crops, moss, etc. The character of the soil, whether moist or dry and whether clay, sand, loam, humus, or rocky, should be listed.

Inasmuch as the topographical features effect the distribution of many animals, the record should state whether the land is high or low, and the exact elevation should be given when possible. The field record should also specifically state whether the animal was observed on a hillside, in a valley, or on a level plain. Since many forms prefer the woodland, it would be well to state whether the animal was seen in the shade or in the open. Specific localities such as: along a stream, in a hollow tree, in a cave, etc., should always be included. The record should further indicate the activities of the animal such as: swimming, walking or running, burrowing, or flying. Any observations as to solitary or gregarious habits should be carefully noted.

The Defenses of Mammals

It is well, in studying any animal, to consider its means of self defense. Reference has already been made to the part that color plays in animal defense. In

addition to protective coloration, animals have other methods of resisting the attacks of their enemies and for capturing their prey.

The swift flight of some mammals constitutes their chief means of defense. These forms depend upon their ability to outdistance their pursuers. Others have large teeth and powerful jaws which are quite capable of seriously injuring their adversaries. Some mammals have long, sharp claws which can do considerable damage. A long hair coat, possessed by certain animals, has been previously discussed from the standpoint of the protection it affords its possessor. Some animals take to water as a means of escape, and these are usually well equipped for diving and swimming.

Modified hairs, like the quills of the porcupine, the scales of the armadillo, and the horns of deer, serve admirably for defensive purposes. Many forms are able to scamper up trees or to dart into narrow underground passages and thus get out of reach of possible enemies. The borrowing forms invariably have several exits to insure escape, in case their burrows are invaded by enemy forms.

Some mammals, such as the skunk, weasel and otter, emit unpleasant odors to discourage the attacks of other forms.

There are other aspects of defense which space forbids discussing, but the student will derive a real pleasure in discovering the various ways and means that animals have of protecting themselves against innumerable enemies.

Interrelationships Among Mammals

The relationships that exist among animals of all kinds present some of the most fascinating aspects of life among the lower forms. No student of animals should overlook the interesting possibilities of such a study. In many cases we observe social structures not unlike those of humans and, in some instances, we can profit by the efficiency of the cooperative systems which characterize various animal groups.

However, the interrelationships existing in the animal kingdom are numerous and sometimes they are difficult to interpret, but, on the whole, any observations which lead to an understanding of animal life will captivate one's interest and contribute to a well balanced understanding of life in general.

There are many things to be considered when one attempts to comprehend just what these relationships are and what they mean. In the first place, there are the relationships bewteen the sexes within a species. It is interesting to observe whether an animal is polygamous or monogamus; that is, what animals select new mates each breeding season, and which ones select a single mate for life. On the other hand, what part does the male play in building the nest and caring for the mother and young, and to what extent does he generally exercise paternal care for his family. In some animals the male will fight for both its mate and its young, he will carry food to the mother while she is producing and caring for the little ones, and he will, frequently, stand guard over the home and fight valiantly for the protection of his own.

In some groups there are bitter struggles among rivals for certain females. Oftimes, after the mating

season is over and after the young have been born, the male will, if he has the opportunity, kill the young. In such cases the female drives the male away and does not permit him to linger about the nest after the young have been born.

The courting habits of both sexes in all animal groups are always interesting to observe, as is shown in the courting of birds, for instance. Frequently the male is larger, more powerful, and better equipped for protection than the female. As in birds, the male often has a more brilliant color and sometimes he has additional structures which are of purely secondary sexual character. In birds these structures are spurs, long tail feathers, crests, etc. In the peacock, for example, the large fan-shaped tail of brilliantly marked feathers that distinguishes the male from the female is a secondary sexual adornment. In mammals these structures may be extra hair tufts, a longer and more bushy tail, larger and longer canine teeth, long horns, etc. Sometimes mammals have scent glands and other means by which they are able to find one another, and "calling" is a common method of attraction.

There are some mammals that live singly, or in pairs. Others live in colonies. Some, like the Wolves, travel and hunt in great packs, in order that they may unite in "bringing down" larger animals. These forms however, do not usually manifest a very great amount of altruism and, after killing a victim, they will often indulge in greedy fights over the carcass. Cattle and horses, as well as other gregarious animals, travel also in herds, chiefly for mutual protection. In a beaver colony all of the members will work together in per-

fect harmony in the repairing of a dam that has been broken.

Although the common rabbit is more or less solitary, it will (like the Beaver which slaps the water violently with its tail when danger approaches) warn the rest of the rabbits of approaching danger, by thumping the ground with its hind feet. The common deer will likewise raise its tail and flash the white under side as a warning to other deer that might be in the neighborhood when it hurries away from apparent danger. The loud screams of many forms, which live in close proximinity, serve the same purpose.

In every situation there are always a number of kinds of animals. There are then involved, relationships among animals of different species. Occasionally, this relationship, between two or more different species, is a symbiotic one; that is, these species live in a partnership that benefits both or all kinds. When different kinds of animals live in the same region, there is always a series of antagonistic groups which usually narrow down to relationships in which only one member of an association benefits. This results in a parasitic relationship, or, in a relationship between predator and prey, the one killing and feeding upon the other. Minks, weasels, otters, raccoons, bears, skunks, wildcats, shrews and foxes are predators and their prey consists of rats, mice, birds, squirrels and many other smaller animals. In nearly all predatory groups, the predators will feed upon each other, when the opportunity to do so presents itself.

It is certain that "everything has its Satan" and, likewise, every animal has its enemies. Sometimes there are certain animals that limit their diet to one

or a few species of other animals. When there is a scarcity of food animals, there will naturally be a shortage of those that feed upon them. It is interesting to note that when there is a sporadic increase of some form, as oftimes happens with certain mice, there is an immediate increase of its natural enemies, such as owls, weasels and shrews. In the winter of 1926 there was an abundance of snowy owls in the state of Pennsylvania, where this form is usually scarce. In this case there was probably a scarcity of Arctic Hares, on which these owls generally feed in their northern haunts, and the birds moved southward to a place where there was a greater winter activity of animals.

The extermination of any form should not be undertaken unless its habits are well-known, because, not infrequently, when an animal is exterminated, the equilibrium of nature is destroyed. When some animal, which is not seriously pestiferous, has its enemies eliminated, it will increase with amazing rapidity and will often become a serious menace.

The greatest weapon that the Economic Zoologist has in combating a certain pest, is some other animal that will feed upon it or that will parasitize it. The most effective checks on destructive animal forms are always natural ones in the form of enemies. The reason for the increase of pests which have been introduced from other countries is that their natural enemies were not imported with them. In many cases, such as the Japanese Beetle and numerous others, the introduced animals are more abundant and, therefore, many times more destructive here, than in their native lands, because of the absence of their natural enemies.

There is no doubt that weasels reduce the numbers of smaller game animals and game birds. For this reason the State Game Commission is endeavoring to exterminate the weasel in order that hunters will have more game. On the other hand, it has been proved that weasels keep down the number of rats, mice, rabbits and other destructive rodents. Therefore, a complete extermination of the weasel will undoubtedly cause an increase of these destructive forms. On the other hand, the extermination of the mountain lion or cougar and the wolf, as well as the reduction in numbers of wildcats, has made possible the increase of wild deer.

It is, therefore, well for the student of mammals to consider all of the relationships that exist among them and to observe carefully the laws of balance in nature. Information concerning these various aspects of the interdependence of mammals will be of great economic value and will certainly make the study of all wild life more attractive. Only a thorough knowledge of the habits and activities of animals should guide man's interference.

This study of interrelationships is tremendous and, in many cases, much is yet to be learned. While the foregoing paragraphs merely indicate some of the possibilities in such a study, it is hoped that enough has been given to stimulate further observations.

The Hibernation of Mammals

As the winter season approaches, one sees a gradual decrease in the number of living things. From late August until the first snow fall, there is a general exodus of forms into the realms of obscurity. Where

do all of these creatures go? Perhaps the migration of the birds and the disappearance of insects are most noticeable, but investigation shows that many of the mammals also have ceased to remain as a part of the winter contingent.

The ability of birds to travel great distances enables them to migrate to warmer regions to the southward, where life is active all of the year. The insects, because of their remarkable life histories, are able to survive the winter in immature stages, such as eggs and pupae, although some of them have larvae which burrow deep into the ground. And some insects, such as beetles, bugs, and even certain butterflies, (the Mourning Cloak, for example) hide in protected places in the adult stage. The snakes, frogs and toads, being seriously affected by low temperatures and the scarcity of food, are forced to crawl into burrows or cavities, or, in the case of frogs, to bury themselves in the mud at the bottom of ponds, where they remain inactive until warmer temperatures stimulate activity.

While many of the animals such as weasels, minks, otters, foxes, rabbits and numerous others are active all year, there are some forms which are forced by several factors to retire during the winter months. Some of these are unable to walk over the heavy snows and are therefore forced to remain within their homes for long periods when the unusually thick blanket of snow persists. Even the cotton-tail rabbit is, at times, unable to make suitable progress under such conditions. On the other hand, the Arctic Hare is provided with large, broad, feet with extra hair growths, which adapt the animal to snow travel. The shrews and moles burrow through the snow.

The red squirrel stores up large quantities of nuts and seeds for winter use, but the gray and fox squirrels keep searching all winter long for food. White-footed mice, jumping mice, meadow mice, flying squirrels and wood rats also fill their storehouses for winter use. While these animals are quite inactive, they do not enter into an unconscious state, but feed lightly from time to time. The wildcat, like the weasel and shrew, never stops its predaceous activities. The beaver and muskrats, while not so active as in the summer, do venture forth at times during the winter months, remaining within their huts during severe spells of weather.

However, there are certain forms which feed voraciously during the summer months and build up large quantities of fat. When cold weather approaches, these animals retire to their nests, where they are safe from freezing, and enter a deep sleep. All of their activities and vital processes are reduced to a minimum, so that their metabolic rate is low. Here they remain dormant in their seclusion, breathing faintly, and gradually absorbing the surplus of fatty tissues that were built up during the summer months.

The bats immediately seek the recesses of caves and hollow trees when insect life ceases activity. The raccoon wanders about until late, seemingly reluctant to give up its regular diet. But severe weather, which freezes the ponds and streams, forces it to seek a comfortable nest, where it, too, enters the land of Nod.

Long before the raccoon retires from the field, the woodchuck has entered its winter sleep and, down below the frost line, one may find it in a comatose state, snuggled against another bed-fellow for comfort.

Even the bear, not relishing long tramps through the snow for food which is scarce at this time of the year, makes an excavation under a tree stump, scrapes in some leaves for bedding and crawls in. There it sleeps, ever so lightly, through the severest parts of the winter, venturing forth occasionally on mild days. It is interesting to note that bears mate before the hibernating season and the young are born while the mother rests after a strenuous summer.

Some other forms breed during the winter months and others, which remain concealed during the winter, are probably engaged in activities of which we know nothing. Hibernation is still a fertile field for some interesting study.

The Conservation of Wild Life

Many animals that formerly inhabited sections of Pennsylvania within recent times, have passed from the fauna. Among these may be listed the cougar or mountain lion, wolf, elk, and probably, the marten. Even the beaver became so scarce that it was thought its days were numbered. While the beaver is still rather limited in numbers, protective laws have enabled it to recover some what and present indications are that it is staging a successful comeback.

Many years ago, game of many kinds was abundant in the state. Indiscriminate killing soon gave evidence that within a short time, little in the way of sport, could be hoped for. With the vanishing of wild life came the realization that something had to be done to prevent extermination of many forms. Consequently, Game laws regulating the killing of certain animals.

were passed. Unfortunately the habits of many animals were unknown and many forms, excluded from the protected lists, were slaughtered in great numbers because they were thought to have been destructive. Some of these were completely exterminated before their real habits were learned. On many of these animals, bounties were paid by the State. Others fell victims to the traps of fur hunters. Many animals suffered from the removal of other forms which served as food, while still others were unable to cope with the changes effected by the advent and spread of civilization.

At the present time the Game Commission offers bounties on wildcats, foxes and weasels. The menace of the wildcat has been reduced considerably. The gray fox which can climb and jump to amazing heights, is more destructive than the red fox. Both destroy small game and birds. The weasel is still plentiful enough to be destructive. While certain measures must be adopted for the control of destructive animals, the writer insists that it is poor psychology to encourage any boy of adolescent age to wantonly kill. The State Game Commission has successfully introduced more humane methods of eradication.

In recent years, Pennsylvania has recovered its former attractions for the hunter. The establishment of the Game Commission has been largely responsible for the increase in wild life. Through the efforts of this body State parks and forests have been acquired. These have been stocked with wild animals, and excellent methods of protection have been introduced, with great success. But the Commission realized that a constructive program could not be carried out without the cooperation of the public, so they immediately began

an educational campaign to enlist this cooperation. Through the success of their efforts, combined with the teaching of Nature in the public schools, there has developed a sportsmanlike attitude on the part of hunters in general. Today Pennsylvania stands out prominently as one of the great game states in the Union and we now enjoy the privileges of a Commonwealth well provided with abundant material for the study of wild life.

The Teeth of Mammals

In the mammals the teeth display a great variety of size and form, according to the manner in which they are used. Inasmuch as mammals are usually somewhat limited in their diets, there have developed dentitions so remarkable in character that one can differentiate among animal groups, and even determine, to a large extent, the diets of the various forms by observing the specialized character of their teeth. Some mammals are addicted to strictly plant-eating habits, others limit their food to the flesh of other animals, while still others are indiscriminate in their feeding habits, devouring both plant and animal structures and products. Consequently, there exists a wide variation in the sizes, numbers, form and distribution of the various tooth formations in mammalian groups. The primary function of teeth is to seize and masticate food. They are also, in many groups, excellent weapons of defense and offense. The animals which feed on others are called Carnivores, or carnivorous animals. Those which feed upon insects are called Insectivores, or insectivorous animals. Those which feed entirely upon plants are called Herbivores, or herbivorous animals. The Fox, Otter, Mink, Weasel, Wild

Cat, etc., are Carnivores. Bats, Skunks, Shrews and Moles, are Insectivores, while Wood-chucks, Squirrels, Woodrats, Deer, and many Mice are Herbivores. The beasts of prey have teeth adapted to tearing flesh and crushing bones; plant-eaters have teeth fitted for cropping plants and triturating vegetable tissues; insect-eaters have teeth with numerous sharp-pointed cusps, and some of these animals, like the ant-eaters, have no teeth at all. Usually, in the different groups of mammals, the number of teeth is fixed and more or less constant. There are four distinct types of teeth in mammals: (1) INCISORS, or front teeth, which are sharp, and more or less elongated, according to the group. They are used chiefly for biting and gnawing: (2) CANINES, or eye teeth, of which there is only one on each side next to the incisors; (3) the PREMOLARS, called the bicuspids in man, which are the anterior grinding teeth. These are located just back of the canines, and (4) the MOLARS, or posterior grinding teeth. These are the hindermost teeth and have more nearly flattened surfaces. As a rule, mammals have two sets of teeth during a lifetime. The first series is temporary and is called the "milk teeth." This series usually differs considerably from the adult dentition. For instance, in humans the posterior molars are not present in the milk or baby teeth. While in man there are the same number of each kind of teeth in both jaws, upper and lower, this is not always the case in all animals. For example, the sheep, which is an herbivorous animal, has no incisors or canines in the upper jaw, but it has three incisors and one canine on each side of the lower jaw.

The structure of mammalian teeth varies so greatly that it would be necessary to indulge in a detailed

discussion of the materials which compose them, as well as the origin of these materials, in order to convey a real idea of their true natures. However, it might be well to direct attention to a few of the more general features.

The teeth of horses, cattle, beavers, etc., continue to grow in length for a long time and do not form roots until late in life. This is because they feed on abrasive substances and the growth compensates for the wear upon them. The chisel-like incisors of rodents grow during the entire life of the animal and are kept at a more or less constant length by use. Should a wood-chuck, for instance, lose one of its incisors, thereby leaving the opposing one without a surface to grind against, the existing tooth would continue to grow in length until it would eventually lock the jaws and prevent feeding.

It might be mentioned that the hard enamel is present only on the front face of the incisors in rodents and, as the animals feed, the softer portion (dentine) behind wears away much more rapidly, thus maintaining a sharp, beveled, cutting surface. This is quite noticeable in Beavers.

The Skeleton

To a person unfamiliar with the Phylogenetic development of animals, and especially to anyone who is not acquainted with the details of vertebrate construction, the skeletons of mammals would seem to be of diverse character. However, a comparative study of the corresponding parts shows the skeletons of mammals in general, to be remarkably similar in character, in fact, they are, bone for bone, almost identical. The

SKULL OF WHITE TAILED DEER
A plant eating animal. Note the absence of canine teeth.

different shapes of mammals are due to the fact that certain bones may be larger or smaller, and of different form, than the corresponding bones in other species. The mammalian skeleton is composed of two main portions, the AXIAL, and APPENDICULAR. The former includes the SKULL, BACKBONE or VERTEBRAL COLUMN, RIBS, and BREAST BONE or STERNUM. The APPENDICULAR portion is composed of the LIMB BONES and the bones attaching them to the TRUNK.

The skull is a highly complex structure, composed of many parts, most of which are immovably joined together. It is the seat of the principal sense organs such as the eyes, ears, nose and mouth. It also affords a well protected cavity for the BRAIN, in addition to carrying the TEETH. The lower jaw is movable and en-

Skull of Black Bear
Showing Carnivorous Dentition.

ables the animal to bite off and masticate food. The section of the skull which carries the brain, eyes and ears, is called the Cranium. The section in front is called the Face.

The Vertebral Column, or Spinal Column, is made up of a number of separate bones called Vertebrae. The Vertebrae are articulated together in such a way as to permit a degree of flexibility and, at the same time, to impart a rigidity which gives the necessary strength to the Spinal Column, or Backbone. The function of the Backbone is two-fold: (1) to support the main part of the body and to afford attachment for the limbs and tail; (2) to hold and protect the Spinal Cord, which is the central axis of the Nervous System. While the Vertebrae differ greatly in form and appearance, particularly in the region of the Neck, they are, nevertheless, constructed on the same general plan.

The body of each Vertebra is called the Centrum and the Centra are separated by discs of Cartilage or

SKULLS OF FOX (left) AND OTTER (right)

(Note the forward position of the eyes on the otter) showing Carnivorous Dentition.

GRISTLE, which allow of elasticity. Humans are said to be slightly taller in the morning than at night, because of the elasticity of these cartilaginous discs in the Spine. On the upper surface of the Centrum is an arch called the NEURAL ARCH, which encloses the NEURAL CANAL, through which runs the spinal cord.

There are five general regions of the Backbone. They are: (1) the CERVICAL region or NECK, in which there are usually seven vertebrae. Long-necked animals like the Giraffe have no more cervical vertebrae than short-necked ones like the Wood-chuck. The difference is in the length of the vertebrae; (2) the THORACIC region which includes the vertebrae to which the Ribs are attached; (3) the LUMBAR region, including the vertebrae back of the Thoracic region to the (4) SACRUM, which includes a variable number (2-13) of fused vertebrae, which appear as a solid structure and to which the hind limbs are attached; and (5) the CAUDAL region, including the vertebrae of the tail.

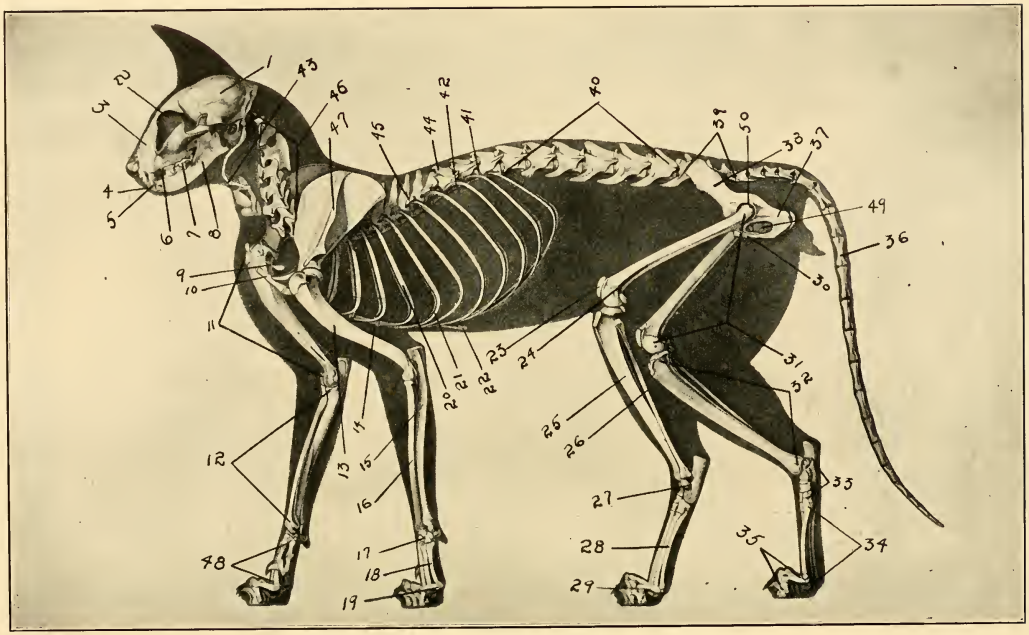
The APPENDICULAR skeleton consists of the LIMB GIRDLES and the bones of the Limbs and Feet. The Limb Girdles are the means of attaching the limbs to the body in such a way as to allow of mobility. The

SKULLS OF RABBIT (left) AND WOODCHUCK (right)
Showing Herbivorous Dentition, Contrasted With the Carnivorous Dentition of the Mink (center).

shoulder, or PECTORAL GIRDLE, has no direct articulation with the Vertebral Column and is held in place by MUSCLES. It is made up of the Shoulder Blade, or SCAPULA, and the Collar Bone, or CLAVICLE, although not all Mammals possess the latter.

The posterior girdle is called the PELVIC GIRDLE, which is attached to the Sacral Vertebrae, and affords a solid support for the hind legs. The Pelvis is composed of three parts, the ILIUM, the ISCHIUM and the PUBIS, which are separated in young Mammals but fused together in old ones. These three parts are united in a deep, hemispherical pit called the ACETABULUM, which receives the head of the Thigh bone in a ball and socket manner.

The limbs are composed of three segments. In the Fore limbs they are the UPPER ARM, FORE ARM and the HAND. In the hind limbs they are the THIGH, LEG (Shank) and the FOOT. The upper bone in the Arm is the HUMERUS, and those of the fore-arm are the RADIUS and the ULNA. The fore-foot, or hand, is also composed of three parts, corresponding to the WRIST, PALM, or back of Palm, and the FINGERS. The bones of the Wrist constitute the CARPUS: those of the back and palm, the METACARPUS: and those of the fingers or



The Skeleton of a Typical Mammal—(The Cat)

Bones of the Cat

1. Cranium
2. Eye Socket
3. Face
4. Eye Socket
5. Canine
6. Premolar
7. Molar
8. Mandible
9. Clavicle
10. Manubrium
11. Fore Arm
12. Arm
13. Humerus
14. Sternum
15. Ulna
16. Radius
17. Carpus
18. Metacarpus
19. Phalanges
20. Rib
21. Costal Cartilage
22. Xyphoid Process
23. Patela
24. Femur
25. Tibia
26. Fibula
27. Tarsals
28. Metatarsals
29. Phalanges
30. Ischium
31. Thigh
32. Leg
33. Ankle Bones
34. Foot
35. Toes
36. Caudal Vertebra
37. Pubis
38. Ilium
39. Sacrum
40. Lumbar Vertebra
41. Intervertebral Disc
42. Centrum
43. Hyoid
44. Spine
45. Articulation for Rib
46. Cervical Vertebra
47. Scapula
48. Palm
49. Obturator Foramen
50. Acetabulum

toes, the PHALANGES. The bones in the hind limb are somewhat similar to those in the front or fore limbs. The upper, or thigh bone, is the largest and is called the FEMUR. The bones of the lower limb are the TIBIA, or shin bone, and the FIBULA, which is the outer bone. The latter is not well developed in horses and ruminants and exists in these as a splint fused to the Tibia.

The foot bones of the hind limb are also similar to those of the fore-foot, and the three parts are called the TARSUS, METATARSUS and PHALANGES. The upper bones of the Tarsus are peculiarly modified to form the ANKLE JOINT and the HEEL.

An animal may walk with the entire sole of the foot in contact with the ground, as do Raccoons and Bears. Such an animal is called PLANTIGRADE. When it walks on its toes, like the dog or cat, it is called a DIGITIGRADE animal. By studying the manner of walking in the various animals, one can soon learn to recognize tracks left in mud or snow. Trailing animals is real sport. Fig (7) shows the tracks of some of the more common mammals.

This brief description of the Mammalian skeleton is far from complete, but it is the wish of the writer to avoid the inclusion of a long list of technical terms and, too, space would not permit of a full description. This much has been given to show the general structural features of mammals. The reader may learn the other structures and their arrangement from the labeled skeleton on plate (6).

TRACKS OF NATIVE MAMMALS

1. Muskrat
2. Fox Squirrel
3. Woodchuck
4. Skunk
5. Meadow Mouse
6. Deer Mouse
7. Brown Rat
8. Weasel
9. Rabbit
10. Varying Hare
11. Raccoon
12. Little Chipmunk
13. Shrew
14. Mink
15. Fox
16. Red Squirrel

In order to differentiate among the constantly growing list of animals and to establish some method of naming them that would serve as a universal standard, Carl von Linné, in 1768, made an attempt to organize animals of obvious relationship into groups, according to characters common to a great many individuals.

While the Linnaen systen has been modified and improved to a large extent, the present system retains much of its original character. Too frequently the mentioning of a scientific name stultifies interest. To many persons it sounds "highbrow," and immediately they set up an antagonism toward it. But it must be remembered that common or vernacular names are wholly unreliable and there may be a dozen common names for the same creature, even within a limited area. A person from one part of the range of some widely distributed form would not recognize the animal by the common name in another section. Many people in Pennsylvania at the present time believe that the woodchuck, marmot and groundhog are three different animals, when these names are all applied to the same individual.

After all, a scientific name isn't any more difficult than many other words which we all acquire in our daily conversations and reading, in a less conscious way. Such words as crepe de chine, lavaliere, table d'hote and automobile, are just as foreign in their make-up and meaning.

As a rule, the scientific name of an animal has a real significance and one can soon become accustomed

to using it in the same manner as he uses the local and common names.

The chief groups of animals are: PHYLUM, CLASS, ORDER, FAMILY, GENUS and SPECIES. To these are frequently added SUBPHYLUM, SUBCLASS, SUBORDER, SUBFAMILY, SUBGENUS, SUBSPECIES and VARIETY, but for present purposes it is not necessary to involve these.

The Phylum is composed of a great number of individuals that have some outstanding characteristic by which all members of the group can be immediately distinguished. For instance, the Phylum CHORDATA includes all animals that have a spinal column, although the primitive members of the group do not have an articulated, ossified backbone. All of the Vertebrates belong to this Phylum. However, it is necessary to discriminate among Fishes, Amphibians, Reptiles, Birds and Mammals, all of which are true Vertebrates. So the Phylum is broken up into somewhat smaller groups known as CLASSES, such as PISCES, AMPHIBIA, AVES and MAMMALIA, each of these Classes having some characteristic that no other class possesses. Since considerable variation exists within a Class, there must be still more specialized groups in which the characters are less. Thus the Class is divided into ORDERS. The Mammals, for example, include many diverse forms, so the hoofed animals are placed in one Order; the Rats, Beavers, etc., which are Gnawers, are included in another order, and so forth. The Orders are, in turn, divided into FAMILIES, so we find the Deer Family a constituent part of the Order of Hoofed animals.

The Families are divided into GENERA and the GENERA are divided into SPECIES, which indicate individuals. The Scientific name of an animal is a com-

bination of the Generic and Specific names, as originally proposed by Linneus. The use of the two names is called the Binomial System of Nomenclature. The use of a third name indicates a subspecies. The system of naming animals in this way is an attempt to distinguish among closely related individuals. For instance, a family may have the generic name of Smith, but, there being several members of the family, it is necessary to assign specific names to the various members of the family, so there may be John Smith, Katherine Smith and William Smith.

The Classified list of Pennsylvania Mammals on the following pages will serve to illustrate the organization of scientific Classification.

The Orders of Pennsylvania Mammals

There are about fifteen orders of Mammals in the whole world. In the United States only nine of these orders are represented. The Pennsylvania Mammals are grouped into six orders as follows:

1. Marsupialia—Opossums.
2. Chiroptera—Bats.
3. Isectivora—Moles and Shrews.
4. Carnivora—Dogs, Wolves, Foxes, Bears, Minks, Weasels, Raccoons, Skunks, Otters, and Cats.
5. Rodentia—Rats, Mice, Squirrels, Woodchucks, Beavers, Porcupines, Chipmunks, Rabbits, and Hares.
6. Ungulata—Deer, Cows, Horses, and Pigs.

The following Key will assist in distinguishing the various orders:

a Marsupial pouch present.....1. Marsupialia
aa No marsupial pouch
  b1 Hind limbs present
    c1 Flying Mammals.....2. Chiroptera
    c2 Non-flying Mammals
      d1 Feet with Claws and not with hoofs
        e1 Canine teeth present
          f1 Limbs used for running and walking—not swimming
            g1 Canines small 3. Insectivora
            g2 Canines large and prominent 4. Carnivora
        e2 Canine teeth absent 5. Rodentia
      d2 Hoofed Mammals 6. Ungulata

The Families of Pennsylvania Mammals

The Pennsylvania Mammals represent 16 Families which may be determined in the following outline:

(1) The Order Marsupialia is represented in the State, in fact in all America by a single family: Opossum: DIDELPHIIDAE

(2) The Order Insectivora is represented by two families:

1. Fore feet very large and modified for digging: Moles: TALPIDAE
2. Fore feet not modified for digging, Shrews: SORICIDAE

(3) The Order Chiroptera is also represented by a single family: The Bats: VESPERTILIONIDAE

(4) The Order Carnivora is represented in the State by five families, as follows:

a Claws not retractile

b Tail rudimentary: Bears 1. URSIDAE

bb Tail well developed and long

c Feet digitigrade: hind foot with 4 toes: Foxes 2. CANIDAE

cc Feet plantigrade: hind feet with 5 toes: Raccoons 3. PROCYONIDAE

aa Claws more or less retractile

b Hind foot with 5 toes: Weasels and Skunks 4. MUSTELIDAE

bb Hind foot with 4 toes: Wildcat 5. FELIDAE

(5) The Order Rodentia is represented by six families:

[a]1 Tail present
[b]1 Two upper incisors present
[c]1 Tail cylindrical or compressed laterally (except flying squirrel)
[d]1 No quills in the fur
[e]1 Not more than three well developed grinders in each jaw
[f]1 Hind legs not elongated: rats and mice 1. MURIDAE
[f]2 Hind legs elongated for jumping: Jumping mice 2. ZAPODIDAE
[e]2 At least 4 well developed grinders in each jaw
[g]1 Tail long or moderate: Squirrels and Woodchucks 3. SCIURIDAE
[d]2 Long quills present in fur: Porcupines 4. ERETHIZONTIDAE
[c]2 Tail large and flattened: Beavers 5. CASTORIDAE
[b]2 Four upper incisors present: Rabbits and Hares 6. LEPORIDAE

(6) The Order Ungulata is represented by a single family, The Deer 1. CERVIDAE

A CLASSIFIED LIST OF PENNSYLVANIA MAMMALS

There are about fifty-nine species and subspecies of Mammals to be found within the confines of the State. The nomenclature and sequence is based upon that used in Miller's "List of North American Recent Mammals." The list with complete classification is as follows:

Class MAMMALIA

Order Marsupialia

Family Didelphiidae (Opposums)

Common Opposum	*Didelphis virginiana virginiana* Kerr

Order Insectivora

Family Talpidae (Moles)

Brewer's Mole	*Parascalops breweri* Bachman
Common Mole	*Scalopus aquaticus aquaticus* Linnaeus
Star Nosed Mole	*Condylura cristata* Linnaeus

Family Soricidae (Shrews)

Common Shrew	*Sorex personatus personatus* Geoffroy
Smoky Shrew	*Sorex fumeus fumeus* Miller
Marsh Shrew	*Neosorex albibarbis* Cope
Mole Shrew	*Cryptotis parva* Say
Short Tailed Shrew	*Blarina brevicauda brevicauda* Say

Order Chiroptera

Family Vespertilionidae (Bats)

Little Brown Bat	*Myotis lucifugus lucifugus* LeConte
Silver Haired Bat	*Lasionycteris noctivagans* LeConte
Georgia Pygmy Bat	*Pipistrellus subflavus subflavus* Cuvier

New York Pygmy Bat	*Pipistrellus subflavus obscurus* Miller
Big Brown Bat	*Eptesicus fuscus fuscus* Beauvois
Red Bat	*Nycteris borealis borealis* Miller
Say's Little Brown Bat	*Myotis subulatus subulatus* Say
Hoary Bat	*Nycteris cinerea* Beauvois

Order Carnivora

Family Ursidae (Bears)

Black Bear (Cinnamon Bear)	*Euarctos americanus americanus* Pallas

Family Procyonidae (Raccoons)

Raccoon	*Procyon lotor lotor* Linnaeus

Family Mustelidae (Weasels, skunks, otters)

Marten	*Martes americana americana* Turton
Least Weasel	*Mustela allegheniensis* Rhoads
Common, or Long Tailed Weasel	*Mustela noveboracensis noveboracensis* Emmons
Bonaparte's Weasel	*Mustela cicognanii cicognanii* Bonaparte
Mink (Northern)	*Mustela vision vision* Schreber
Mink (Southern)	*Mustela vison Mink* Peale and Beauvois
Otter	*Lutra canadensis canadensis* Schreber
Skunk	*Memphitis nigra* Schreber

Family Canidae (Foxes)

Red Fox	*Vulpes fulva* Desmarest
Gray Fox	*Urocyon cinercoargenteus cinereoargenteus* Schreber

Family Felidae (Cats)

Wildcat: Bobcat	*Lynx rufus rufus* Schreber

Order Rodentia

Family Sciuridae (Squirrels)

Woodchuck: Groundhog	*Marmota monax monax* Linnaeus
Chipmunk	*Tasmias striatus striatus* Linnaeus
Gray Squirrel: Black Squirrel	*Sciurus carolinensis leucotis* Gapper
Red Squirrel (Southern)	*Sciurus husdonicus loquax* Bangs
Red Squirrel (Northern) pine	*Sciurus hudsonicus gymicus* Bangs
Fox Squirrel (Western)	*Sciurus niger rufiventer* Geoffroy
Fox Squirrel (Eastern)	*Sciurus niger niger* Linnaeus
Flying Squirrel	*Glaucomys volans volans* Linnaeus

Family Castoridae (Beavers)

Beaver	*Castor canadensis canadensis* Kuhl

Family Muridae (Rats and Mice)

Deer Mouse: White Footed Mouse	*Peromyscus maniculatus maniculatus* Wagner

Cloudland Deer Mouse	*Peromyscus maniculatus nubiterrae* Rhoads
Rafinesque's Deer Mouse	*Peromyscus leucopus leucopus* Rafinesque
Fischer's Deer Mouse	*Peromyscus leucopus noveboracensis* Fischer
Allegheny Cave Rat: Wood Rat	*Neotoma pennsylvanica* Stone
Red Backed Mouse: Wood Mole	*Evotomys gapperi gapperi* Vigors
Pennsylvania Meadow Mouse	*Microtus pennsylvanicus pennsylvanicus* Merriam
Northern Pine Vole: Mole Mouse	*Pitymys pinetorum scalopsoides* Audobon
Muskrat	*Ondatra zibethica zibethica* Linnaeus
Black Rat	*Rattus rattus rattus* Linnaeus
Roof Rat	*Rattus rattus alexandrinus* Geoffroy
Common House Rat: Brown Rat	*Rattus norvegicus* Erxleben
Common House Mouse	*Mus musculus musculus* Linnaeus
Lemming Mouse: Cooper's Lemming Mouse	*Synaptomys cooperi* Baird

Family Zapodidae (Jumping Mice)

Meadow Jumping Mouse	*Zapus hudsonicus hudsonicus* Zimmerman

Eastern Meadow Mouse	*Zapus hudsonicus americanus* Barton
Woodland Jumping Mouse	*Napaeozapus insignis insignis* Miller

Family Erethizontidae (Porcupines)

Porcupine	*Erethizon dorsatum dorsatum* Linnaeus

Family Leporidae (Hares)

Varying Hare:Snow Shoe "Rabbit"	*Lepus americanus virginianus* Harlan
Southern Cotton Tail: Wild Rabbit	*Sylvilagus floridanus mallurus* Thomas
Eastern Cotton Tail	*Sylvilagus floridanus mearnsii* Allen

Order Ungulata (Artiodactyla) even toed Ungulates or Hoofed Animals

Family Cervidae (Deer)

Virginia White Tailed Deer	*Odocoileus virginianus virginianus* Boddaert

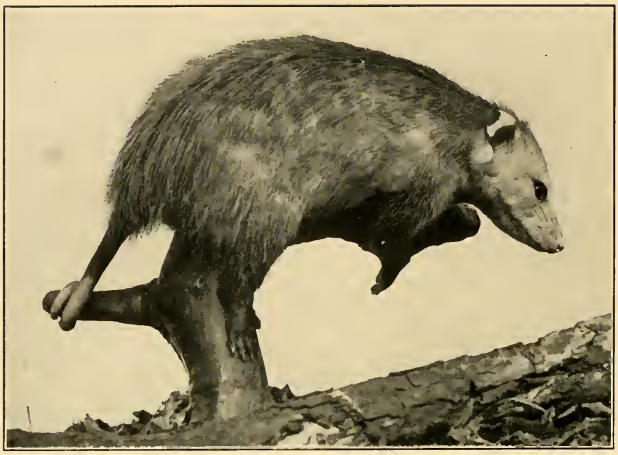
The Virginia Opossum

Didelphis virginiana virginiana

Although the opossum is one of the commonest and best known of our native animals, it is surprising how few people have had the opportunity to observe it in its native haunts. The writer, while driving through Schenley Park in the city of Pittsburgh, on a summer's night, came suddenly upon an opossum that was leisurely crossing the road. The creature, dazed by the lights of the car, stopped and remained motionless in its path. Dismounting, the writer was able to approach to within a few feet of the animal before it slowly ambled off the highway and disappeared in the surrounding shrubbery. When one can see the opossum within the heart of a large industrial city, it is pretty good evidence that it is far from being exterminated.

The Virginia opossum usually lives near streams and lakes in well wooded sections. It is slow moving and sluggish, and appears to be quite stupid. It is nocturnal in its habits and is a very shy animal. Its interesting habit of "having fits" or feigning death when attacked is well known and has given rise to the saying "playing 'possum."

The opossum is a Marsupial animal, like the kangaroo of Austrialia. Its method of producing young differs materially from the rest of the mammals. The young, numbering from 5 to 14, are born in a very much undeveloped state, having not even a well defined form. They are not attached to the parent by an umbilical cord and placenta as are most mammals, and upon birth they are placed within the mother's pouch which is located on the belly. Within the pouch are



Opossum *Didelphis virginiana virginiana*

the nipples, to which the young attach themselves and hold fast until development has advanced considerably. After the eyes are open, and after a coat of fine silken hair has appeared on the bodies of the young, they occasionally leave the pouch and crawl about over the body of the mother, clinging to her hair with their tiny handlike fore feet. Sometimes, as the mother roams about, she may be seen with her tail thrown up over her back and the little ones arranged in a row with their tails wrapped about that of the parent.

The Virginia opossum is the largest of a large assortment of species of Marsupials, most of which are indigenous to Central and South America. It has a rather heavy coat of hair which is of a dirty gray color, and often the hairs are tipped with black. The face is usually lighter in color and the snout is long and

pointed. The ears and tail are naked. The tail is prehensile and is used as a fifth foot. The animal can hang head downward, suspended by its tail.

The home of the opossum is usually in a hollow tree or in a burrow beneath a tree stump, where the animal remains during the day. When darkness has settled it ventures forth on its foraging expeditions. The opossum is an omnivorous creature and feeds on both animal and vegetable matter. It is fond of vegetables and fruits as well as insects and their larvae. It also feeds upon smaller mammals. Sometimes the 'possum includes chickens in its diet and it undoubtedly devours nesting birds and their young.

Like many other animals, the opossum is considerably diminished in numbers by hunters and trappers. It is sought as food and for its fur. But it is still quite common in Pennsylvania. While the opossum is not always beneficial, it has never been a serious menace and the writer suspects that its chicken taking proclivities have been forced upon it by us humans who generally take what we want. Furthermore, we are, frequently, considerably less scrupulous in securing what we desire, than are many of the wild animals. The urge to live is one of the innate instincts in lower animals as well as in humans. It would, indeed, be a source of great regret were the opossum to disappear from our fauna.

The opossum attains a total length of thirty inches, the tail measuring about twelve inches. The toes are long, slender, and widely spread. The fore feet are used as hands, with the toes clasping like fingers. There are five toes on both the fore and hind feet. The first toe on the hind foot is nailless and the soles of the feet

Brewer's Mole *Parascalops breweri*

are naked. The teeth, numbering 50 are sharp and the body is heavy set. The general coloration is gray while the soft underfur is whitish. The cheeks are white; the top of the head and the region around the eyes are blackish; the legs, feet and base of the tail are black; while the ears are black with a yellowish spot on the upper edge. The males and females are alike and there is only a slight seasonal variation.

Common Mole

Scalopus aquaticus aquaticus

The mole is a widely distributed mammal which is little known by the average person because of its habit of living almost entirely underground where it digs a series of ramifying tunnels. Its wanderings are, usually, so near the surface that its burrows may be followed by the ridges which appear on the ground.

COMMON MOLE *Scalopus aquaticus aquaticus*
Note the modified fore feet.
Courtesy U. S. Biological Survey.

The mole feeds on earthworms and insects and renders a real service in destroying cut worms, wireworms, "grubs" and the larvae of other destructive forms, which seriously injure the roots of growing plants.

In its search for food, the creature will often invade lawns and golf courses, where its ridges spoil the evenness of the short grass, and it does not hesitate to swim streams when there is a migratory impetus. The mole nests in a large chamber which is constructed along one of its runways. The nest is lined with soft grasses and dried leaves. There are usually from three to five young in a litter and, although there are probably several litters, it is not certain as to the number of breeding periods in a year.

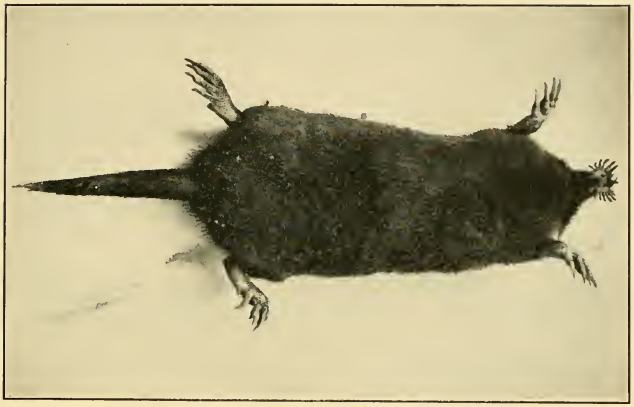
The common mole is a dark slate color, often tinged with brown. The fur has a silvery sheen in sunlight. The under parts are almost as dark as the back. The mole is a thick set burrowing animal with an arched spine. The fore feet are large and broad, and somewhat paddle-shaped for digging. There are five toes on both the fore and hind feet. The head is narrow and pointed; the snout is bare; there is no visible external ear; the neck is short; the tail is long, thick and nearly naked; the eyes are extremely small and not visible externally; the feet and tail are whitish to pinkish; the hair is soft and velvety and is very valuable commercially; the teeth are sharp and numerous (40). The sexes are identical and there is no seasonal variation. The animal is six inches long and the tail, which is sparsely covered with hair, measures one inch. The legs are very short.

The Star Nosed Mole

Condylura cristata

The star nosed mole is easily distinguished from the other moles by the twenty-two fleshy tentacles, arranged radially around the nose. Its color differs slightly from the common mole, being blackish or brownish above, becoming paler beneath. This species is slightly larger than the common mole, measuring seven inches. However, the tail is proportionately longer, totalling almost one-half the body length. In winter the tail becomes very much enlarged.

While not as common as the preceding species, the star nosed mole is generally distributed over the State, inhabiting low marshy regions or low-lying meadows. In addition to establishing a series of underground tun-



Star Nosed Mole *Condylura cristata*
Courtesy U. S. Biological Survey.

nels, this species runs about over the surface of the ground and it has been frequently seen running about on the surface of deep snow. It nests about eighteen inches below the surface in a small chamber along one of its tunnels. The young, numbering from three to five, are hairless at birth and receive the kind attention of the mother for two months.

The feeding habits of the star nosed mole are similar to those of other species, its chief article of diet being insect larvae, beetles and the pupae of Sphingid moths. While the animal is beneficial, its runways are often used by meadow mice which do considerable damage to field crops. The general characters, such as teeth, feet, etc., are similar to those of moles in general.

Brewer's Mole: Hairy Tailed Mole

Parascalops breweri

The habits of the hairy tailed mole are similar to those of the other species mentioned above. It is a

large mole with a short, *densely haired tail,* by which it can be readily identified. The nostrils are crescent shaped and the eyes and ears are so small as to be invisible. The general coloration is a glistening black above, becoming paler beneath and along the sides. The hairs on the feet and nose are brownish. The animal measures a little more than seven inches when full grown but the tail is very short. The nesting habits, food, and litters of young are the same as in the preceding species. This is the commonest of the three native moles.

Common Shrew: Long Tailed Shrew: Masked Shrew

Sorex personatus personatus

The shrews are the smallest of our North American Mammals. Their size, combined with their nocturnal habits, probably accounts for the fact that they are the least known members of the class.

Although this species is called the common shrew, it is by no means the most abundant in Pennsylvania. The shrew lives among piles of chips or stones, or in shallow burrows, and not infrequently in hollow logs. It is usually mistaken for a mouse or a mole when seen scurrying through dead leaves. The shrew is quick and agile and is a deadly enemy of field mice. While it is classed as an insectivore, it is rather omnivorous and eats vegetable matter in addition to insects and their larvae.

While the shrew spends most of its time above the surface of the ground, it forages in the tunnels of Moles and other burrowing forms. In winter it tunnels

Long Tailed Shrew: Smoky Shrew *Sorex fumeus fumeus*

through the snow in much the same manner as do moles. It does not hibernate.

The habits of the shrew are not completely known, but it is believed to be solitary, and bears several litters of young each year. The common shrew is chiefly an inhabitant of the mountainous regions of the State.

It is about four inches long and is covered with a thick, soft hair which is of commercial value. The nose is pointed; the eyes are small, but perceptible; the ears are visible above the fur; the legs are short and slender; and the body is much thinner than that of the mole. The fore feet are not modified for digging as are those of the mole.

The Short Tailed Shrew: Mole Shrew

Blarina brevicauda bravicauda

The short tailed shrew is found in every part of the State in great numbers. It inhabits mountains,

SHORT TAILED SHREW *Blarina brevicauda talpoides*

meadows, ravines, marshes, woods and open fields, yet it is one of the least known of our mammalian fauna.

It is frequently mistaken for the mole, which it resembles, and certainly, it is often mistaken for the field mouse. In color it resembles the latter, being a sooty gray above and an ashy gray below. The fur is dense, soft and glossy, and the sexes are identical.

The shrew is insectivorous and carnivorous, feeding upon insects and their larvae and field mice. Great numbers of grubs, wireworms and other root destroyers are eaten by it and it has also shown rather pronounced cannabalistic tendencies by devouring its fellows. It has been estimated that the shrew will consume food equal to twice its weight in 24 hours. When insects and mice are scarce, the shrew will eat nuts and other vegetable matter.

The short tailed shrew, unlike its long tailed cousin, digs beneath the surface of the ground, where

it is supposed to disturb the roots of food plants, but its removal of the destructive insect larvae compensates for any damage it might do. It generally prefers to remain above ground, however, and may be seen running over the fallen leaves in the woods, along rail fences, and even in the open fields.

The shrew nests in an underground shelter, where the mother constructs a bed of grass and leaves. Mating occurs early in the Spring and two or three litters of from four to six young are born during the year.

The short tailed shrew is about five inches long and the tail measures about one inch. The head is pointed; the eyes are small; and the ears are quite short but visible. All shrews have five toes on each foot, and the fore feet are not modified as in moles. The shrew emits a fetid odor when captured. It does not hibernate, but is active all the year round.

The Smoky Shrew

Sorex fumeus fumeus

The smoky shrew is much larger than the common shrew (Sorex personatus), attaining a length of almost five inches. The tail measures 1.8 inches. The body is slate colored above, becoming slightly paler below. It is similar in habits to the other Shrews.

The Marsh Shrew

Neosorex albibarbis

The marsh shrew is apparently rare in Pennsylvania, its general range being Northeastern America. There are very few records of this species in the State, and they are for the Northeastern part. It is quite possible that it exists in the northern part of the Allegheny

mountains. Certainly, this is the most westerly limit of its range.

In general, it inhabits the marshy regions and confines its wanderings to the swampy margins of lakes and rivers.

The body is a blackish slate color sparingly mixed with white tipped hairs, and ashy gray beneath. The animal measures six inches in total length and the tail is almost three inches long. The habits are similar to those of shrews in general except that this species evidently is semi-aquatic.

Mole Shrew

Cryptotis parva

This is the smallest of our native shrews, totalling only three and one-tenth inches. It is apparently not abundant in Pennsylvania, although no survey of the shrews has been made for twenty-five years.

The upper parts of this species are dark brown and the under side is an ashy gray.

Order Chiroptera (Bats)

Family *Vespertilionidae*

The bats form one of the most interesting and most beneficial groups of mammals. They are entirely nocturnal and, to many people, they are loathesome and fearful creatures. They are not only misunderstood, but dreaded, due to the fact that so many superstitions have been built up around them. Of all native mammals, the bats have been subjected to the greatest persecution because they are believed to carry bedbugs under their wings, and are supposed to become inextricably entangled in one's hair. Like all other mam-

mals, bats are infested with parasites, just as a dog or cat may be infested with fleas, but the examination of thousands of live specimens by the author has never revealed "Cimex lectularis." As to their getting tangled in the hair, such a thing is quite possible but not at all probable, and certainly it would not be necessary to cut off all of one's hair in order to extricate some poor unfortunate creature that might become so enmeshed. The bats have tiny, clinging feet, and on the apices of the wings they have tiny claws which aid in crawling and holding on to the rocks or the bark of trees. These claws are located on the bones that correspond to the thumb and inasmuch as they are used in much the same manner as the latter, the order thus derived its name. With such an equipment, the creature could cause some discomfiture were it to alight on one's head, but no bat ever went around looking for someone's hair to get tangled up in, and should such an occurrence take place, there is no doubt that the Bat would be just as frightened as the victim of such an experience. Although it is equipped with many sharp teeth, such a diminutive creature could not inflict any injury worth worrying about.

Bats should be considered among man's friends, because they are entirely insectivorous. Thousands of mosquitoes, gnats and May beetles are destroyed by a single animal within a short time.

While we may have "bats in our attics," they do not, as a rule, disturb humans, seeming to prefer caves or hollow trees for their homes. Occasionally, they will occupy unused chimneys or lofts in barns and, frequently, they rest under the eaves of a house during the day or hang head downward from twigs of trees, but it is seldom that they become pestiferous.

Many people seem to loathe bats because they are "Mouse like." In reality, they are not closely related to the Rodents and occupy an entirely different order.

Bats exhibit a wide variety of habits and structures. Most of our native forms hibernate during the winter, but there are a number of species which migrate from the northern regions at the approach of cold weather, in much the same manner as do birds.

Usually the hibernating forms assemble in great numbers in caves or in hollow trees where they enter a comatose state, remaining inactive until insect life again becomes active. In the caves they sometimes cover the walls and ceilings, or arrange themselves in huge clusters, apparently for the purpose of keeping warm. The writer has spent considerable time in studying hibernation of bats and has found that they are easily awakened from their sleep and do not hesitate to bite. A pair of kid gloves, however, proves adequate protection. When disturbed in hibernation, the bats will frequently "take to the air." This should be avoided by persons who are interested in their welfare because activity stimulates the metabolic rate and energy is used which the creatures need in reserve for the long sleep ahead. Since insect life is dormant, there is no way of replenishing the supply and the animals starve before Spring.

Bats are characterized from the other mammals by their flying habits for which they are admirably adapted. The true, active, flight of bats must not be confused with the passive, gliding flight of the flying squirrel.

The bats are mammals which have the fore limbs modified for flight. The bones of the arms and fingers

are much elongated, forming a frame work over which extends a membrane which is attached to the sides as well, and extends from the fore limbs to the hind limbs.

Bats are true mammals, being covered with soft hair and possessing the thoracic mammary glands, through which the young are nourished. The ears are well developed and prominent. The number of sharp teeth varies in a number of species.

Bats should receive the kindly protection of mankind in general because most of them are beneficial. That even the Vampire of the Tropics is not nearly so formidable as it is reputed to be, the writer knows from experience.

There are possibly eight species of bats in Pennsylvania, representing a single family, Vespertilionidae.

Common Brown Bat: Big Brown Bat

Eptesicus fuscus fuscus

The big brown bat is one of the commonest of our Pennsylvania species. It is a dark brown or sepia color above and the under parts are slightly paler. The ears and membrane are blackish. The total length of this species is about four and one-half inches. The tail is almost two inches, being the same length as the fore arm.

Like all other native bats, the big brown bat is insectivorous and it makes its appearance rather late in the evening. It flies lower than the red bat and rests during the day in houses, barns, on trees, or under the eaves of a house. It is supposed to be migratory, and

Big Brown Bat *Eptesicus fuscus fuscus*

may be, in the northern limits of its range, but in Pennsylvania it usually hibernates during the winter in caves, attics, or hollow trees. In mild winters it occasionally leaves its winter home for short flights.

The big brown bat is a great destroyer of June beetles, mosquitoes and other night flying pestiferous insects. It can be distinguished in flight by its size, the animal having a wing spread of more than twelve inches. It usually bears two young which may be found attached to the mother at the beginning of the hibernating period.

The bats have numerous sharp teeth with many cusps for crushing the chitinous external skeletons of beetles and other insects.

The Red Bat

Nycteris borealis borealis

The little red bat is the most beautiful of our native bats and vies with birds for a place among conspicuously colored animals. Its general color is a bright reddish brown, paling to a light yellowish red in some individuals. There is also a whitish patch in front of each shoulder. The red bat has a total length of slightly more than four inches and a wing spread of nearly twelve inches.

The red bat frequently rests on the trunks or twigs of trees during the day, hanging head downward, holding on with its tiny claws, and is the first to venture forth in the evening, usually making its appearance before dark. It frequently enters houses and churches in search of food and it generally receives an unwelcome reception.

The red bat is the most solitary of its kind and ordinarily shuns caves where other species congregate in great numbers, although it sometimes congregates in clusters probably during the mating period. The red bat is widely distributed and it migrates from the Northern regions, as do birds, at the approach of cold weather.

The red bats have long narrow wings and are extremely graceful and agile in their flight. Bats are as careful in their protection of their young as are birds and mother bats will often raise quite a fuss when the young are taken from them. The red bat bears from two to four young, which remain with the mother for some time, clinging to her body. Quite often the combined weight of these young ones is in excess of the mother's weight and it is remarkable that she can fly so well with such encumbrance.

That the red bat sometimes winters in caves in Pennsylvania has been proved by the fact that the author found hundreds of them in Delaney's Cave, near Fairchance, Fayette County, during the month of February.

The Little Brown Bat

Myotis lucifugus lucifugus

The little brown bat is similar in coloration to its larger cousin, but its ears and tail are proportionately longer, although its general size is considerably smaller, being only three and one-half inches in length. This species is probably the commonest bat in the State and the author has seen thousands of little brown bats hibernating in Bear Cave in Westmoreland County. While it is said by some writers to venture forth in mild weather, the writer has observed their hibernating habits for a period of five years and in no case did the creature show signs of activity until late in the Spring.

In some cases the bats arranged themselves on the walls of the cave in a compact formation for the winter's sleep. At the same time, others formed "clusters" on the ceilings. Albinos were found among them from time to time.

The little brown bat has a wing spread of nine inches and its tail is almost one-third the body length. There are usually two young in a litter and these remain attached to the mother's breasts until they are old enough to hang up in some secluded spot while the parent searches for food. This creature may be seen on summer evenings in the low lying rural sections of the State.

Silver Haired Bat *Lasionycteris noctivagans*

The Silver Haired Bat
Lasionycteris noctivagans

While it is not particularly abundant, the silver haired bat is quite generally distributed over the State. It differs from other bats in that it possesses a peculiar color which is a brownish black and usually appears to be more black than brown. The dorsal sur-

face is marked with a scattered mass of whitish tipped hairs which are more or less abundant in various individuals, and which gives a grayish or hoary tinge to the upper surface of the body.

The silver haired bat is frequently more abundant in the swampy regions of the State where it flies over the water in much the same manner as a swallow, skimming the surface and picking up floating insects. It is particularly abundant in the Pymatuning Swamp in Mercer and Crawford counties. The total length of the Silver Haired Bat is about four inches.

Say's Little Brown Bat

Myotis subulatus subulatus

This species proximates in size and is simailar in coloration to the little brown bat (Myotis lucifugus lucifugus) with which it is apt to be confused. Like the little brown bat, Say's bat is a pastoral species, preferring the rural sections in which to live and seldom venturing into city districts where the big brown bat (Eptesicus fsucus fsucus) holds sway. Say's bat may be distinguished from the more common little brown bat by the fact that the ears of the latter are considerably shorter. Rhoads (1903) says that the ears of *Myotis lucifugus,* when laid forward, barely reach the tip of the nose, while in *Myotis subulatus,* the ears extend considerably beyond the nose when held in this way. Say's bat seems to have a more limited distribution in Pennsylvania than Myotis lucifugus and seems to be more abundant in Western Pennsylvania. Both of the little brown bats are more likely to be found in lowland sections of the State.

The New York Pygmy Bat

Pipistrellus subflavus obscurus

The New York pygmy bat, while represented in our fauna, is evidently not abundant. It is about the same size as the Georgia pygmy bat, but it differs somewhat from the latter in coloration, being of a dull brownish color and having the blacked tipped hairs on the dorsal surface less conspicuous. Both of the pygmy bats have eighteen teeth in the lower jaw and sixteen in the upper jaw.

The Georgia Pygmy Bat

Pipistrellus subflavus subflavus

The Georgia Pygmy Bat is not generally distributed over the State but is more abundant in the low lying areas of the southeastern and southwestern counties.

This species measures slightly less than three and one-half inches in total length and its general color tone is yellowish with many hairs on the dorsal surface tipped with brown or black. On account of its size, it is apt to be confused with the New York pygmy bat, but the latter is much duller in color and less yellowish. The tipped dorsal hairs are also much more conspicuous in the Georgia species. Although recorded from both the southeastern and southwestern sections, it is probably not very common inasmuch as these sections represent the northerly limits of its range.

The Hoary Bat

Nycteris cinerea

The hoary bat is not abundant in Pennsylvania, but it has been reported from every section of the State. The shape of this species is similar to that of the red

FROM RHOADES *"Mammals of Pennsylvania and New Jersey"*

bat *(Nycteris borealis)*, but it is larger in size, having a total length of five inches and a fore arm over two inches long.

Like the red bat, the hoary bat has the portion of membrane between the hind legs covered with fur, but the latter species has blackish bordered ears and lacks the notch in the lower lobe of each ear.

The color of the hoary bat varies considerably. As a rule, it is a mixture of light yellowish brown, deep umber-brown and white, the yellowish brown being clear and unmixed on the throat, head and under side of the membrane. The umber-brown predominates on the back and on the interfemoral membrane; however, the hairs are mostly tipped with white and frequently the darker tints beneath are concealed.

The lips, chin and cheeks are sprinkled with short black hair. The underside is white and, between the belly and throat, there is a band of light brown. The hairs on the back are tri-colored, being plumbeous at the base, light yellowish brown on the upper part and ending with a tip of silvery white. The red and hoary bats have four mammae and each species bears from two to four young.

The hoary bat does not, as a rule, retire to caves during the day but hangs head downward from the twigs of trees.

Black Bear: Cinnamon Bear

Euarctos americanus americanus

Although the Black Bear or Cinnamon Bear is quite common in the mountainous regions of central and northern Pennsylvania, it is seldom seen by the

average person. However, it graces every Zoo, and its "rolling gait" is a source of amusement to young and old alike. The bear is not a ferocious animal as is commonly supposed, and makes a hasty retreat upon the approach of humans. It will fight viciously when wounded and a mother with cubs is not an amiable creature to associate with.

The bear has a remarkably developed sense of hearing but its eyesight is poor, and it is said to depend upon its senses of hearing and smell for finding food. It is classed as a carnivorous animal and does eat birds, small mammals and, occasionally, young pigs, which it steals from farms in rural counties. But the bear is also very fond of fruits, berries and nuts. Honey is one of its favorite delicacies and since our native bear is an excellent climber, it is able to rob bees' nests of their winter supply. In the late fall or early winter, the bear can frequently be found in forests where the beech tree abides. It feeds on beech nuts and frequently "roots" up the ground with its muzzle to uncover buried nuts.

The bear is almost entirely a forest animal but it frequently wanders into open country and causes concern to farmers who have corn, orchards, bee hives and little pigs. While the bear is, chiefly, a nocturnal animal, it wanders about during the day in undisturbed sections.

A bear hibernates in a cave, in a burrow, or under the stump of a tree. Here it sleeps lightly for a period, dependent upon the severity of the winter, and ventures forth in mild weather. It requires considerable irritation to awaken some hibernating forms, but the bear seems to sleep with "one eye open." Unlike most of the

The Pennsylvania Black or Cinnamon Bear *Euarctos americanus americanus*
Courtesy Carnegie Museum.

larger mammals, the young are born during the winter seclusion of the mother. Usually there are two cubs.

The black bear is easily distinguished from other species of bears by its coat of almost solid color on the body. This varies from a black to a cinnamon brown; hence the two names. The underside is always a light brown while the muzzle is a very light yellowish brown. The bear is characterized by a thick, heavy body; short legs; long, sharp, curved claws; naked soles; and short tail. It is Plantigrade, or flat footed, and leaves tracks similar to those of a barefooted man.

The bear attains a length of almost six and one-half feet and stands about three feet high at the shoulders. The black bear has an arched spine, in which respect it differs from the Grizzly and other species. The tail is very short, being less than six inches. The black bear is the only species found in Pennsylvania and is the smallest of North American bears, but a full-grown specimen will weigh up to three hundred and eighty pounds.

The Raccoon

Procyon lotor lotor

The raccoon is one of the most widely known animals of our native fauna. In the days of political parades it was the most prominent identification mark of a certain political party. The fur of the raccoon has been referred to frequently in connection with the dress of Daniel Boone and other pioneers whose "Coon skin" caps were always mentioned. Because of the ease with which Raccoons can be tamed, they have been raised in captivity and their development and interesting habits are well known.

The curiosity of the raccoon is not exceeded by and other native form. Pet "coons" search one's person carefully, and even vest pockets are not overlooked. They manifest as much curiosity over a mirror or a watch as does a monkey.

The raccoon is a nocturnal animal and lives in the vicinity of streams and lakes, nesting in hollow trees in well wooded sections. It is very fond of crayfish, frogs, mussels and young turtles, and I have seen it stand on a rock in shallow water with one of its fore feet inserted under the rock, feeling about for crayfish. Well-trodden paths along the shores, and the remains of numerous water animals on projecting rocks and partly submerged logs, are pretty good evidence of the presence of the "Coon."

The raccoon invariably washes its food carefully before eating it and is otherwise cleanly in its habits. While it usually hunts on the ground, it is an excellent climber and it is said to eat birds and their eggs. There is no doubt that it will eat young chickens when they are available. However, its woodland habits present few opportunities for chicken dinners. Farmers occasionally complain of the damage done to young corn which seems to be especially favored by raccoons.

Not only is the raccoon a beautiful animal, but its fur is quite valuable and it is remarkable that the creature can survive in face of the demand for "coon skin" coats created by College Freshmen. It is to be hoped that women and fastidious youths will find suitable substitutes for fur and feathers as articles of adornment.

When one thinks of the misery of a trapped animal that is held fast for days by steel teeth which crush

RACCOON *Procyon lotor lotor*
Courtesy Carnegie Museum.

bones and tear flesh, it makes fur garments less attractive. Ofttimes the captured animal dies of cold, thirst, starvation, loss of blood, or suffering. And not infrequently, its sufferings are ended by brutal beating with a club. Perhaps a litter of young in a distant nest die of starvation when a mother fails to return. And after

all, the creature, held in a vice-like grip, has no chance whatever to exercise its natural defenses. The thoughts of such trapped creatures, suffering mortal agony, and besieged by other predatory animals which often prey upon them, are enough to keep one awake at night.

The raccoon is a short-haired, long-legged animal with a broad head, pointed nose, bushy tail, erect ears, and with five toes on all feet. The soles of the feet are naked and it is flatfooted or plantigrade, leaving tracks not unlike that of a small child. The front feet are used as hands.

The color is a brownish gray with black tipped hairs on the back. The undersides are a pale gray and the tail is marked with six or seven black or brownish rings. The face is a dull white with a distinct white band above each eye while there are black patches on the cheeks. These join a black stripe that runs from the nostrils back over the forehead. The animal is almost three feet long and weighs up to twenty-five pounds. There are from four to six young in a litter.

The American Marten: Pine Marten: American Sable

Mustela americana americana

The marten is a long, slender-bodied animal, slightly larger than the mink, to which it is related. It is said to be an excellent climber and is, therefore, an enemy of squirrels and birds. Unlike the weasel, it does not kill for the sake of killing and does not enter cultivated areas. It remains in the recesses of the forests and, in addition to birds and squirrels, it destroys rabbits, but its chief food consists of small rodents and shrews. The marten is shy and cunning and travels about at night.

The home of the marten is usually under rocks or in a hollow tree and not infrequently, it occupies the nest of a squirrel. There is a single litter of from six to eight young each year.

The marten is about twenty-six inches long and is somewhat smaller than a cat. The tail, which is inclined to be bushy, measures eight inches. The general body color is an orange brown above with lighter spots on the throat and breast. The undersides are brownish. The head of the animal is roughly triangular, with the nose somewhat pointed. The legs are short and the soles of the feet are furry. There are five toes on both the fore and hind feet. The ears are large and prominent and the tail is tipped with black. The sexes are similar in size and coloration, and there is very little seasonal variation.

The marten has probably been exterminated, or at any rate is extremely scarce in Pennsylvania. It is most likely to be found in the northern and northeastern sections of the State. The fur is very valuable. The specimen at hand was killed at Winterburne, Pennsylvania.

The Common Weasel: New York Weasel

Mustela noveboracensis noveboracensis

The common weasel is abundant in practically all parts of the State. A cursory examination of its teeth reveals its carnivorous habits. No other native mammal displays a dentition better adapted to capturing and killing other animals than does this little killer of the night.

The well muscled, powerful jaws; low forehead; moderate sized ears; the sharp nose; and the small

LEAST WEASEL *Mustela allegheniensis*
With Almost Complete Winter Pelage.

eyes, give a rather formidable appearance to the flat triangular head. The long neck, long slender body and short legs suggest a strength and agility that compensate for lack of speed.

The serpentine body and short legs are well adapted to exploring the underground burrows of other animals, such as mice, on which it feeds to a large extent. However, the weasel includes rabbits, birds, woodchucks, skunks and many other animals in its diet, and great numbers of domestic fowl are killed by it. The worst feature of the weasel is that it often kills many times as much as it needs. Whole flocks of chickens, turkeys and ducks, may be destroyed in a single night and their bodies, with only the head chewed, are strewn about. As a rule, the weasel sucks the blood, or eats only the brains of its victims. On the other hand,

COMMON WEASEL *Mustela noveboracensis noveboracensis*

the Weasel is a great enemy of rats and other destructive pests.

The weasel usually inhabits the burrow of some other animal or lives in rocky crevices and hollow logs. It sometimes digs its own nest but this is thought to be seldom the case.

The weasel is one of those animals that changes its coat with the seasons and its summer color is yellowish brown above, with the underside a yellowish white. The upper side of the tail is the same as the body but it is tipped with black. In winter the whole body is white, with the exception of a small black mark on the tip of the tail.

The ears are of moderate size and the soles of the feet are hairy. There are five toes on both the fore and hind feet. The weasel bears from two to three litters of five or six young each year.

A full grown weasel is about sixteen inches long. The tail is about one-third the body length and the hind foot measures two inches. The female is considerably smaller than the male, attaining a length of only twelve or thirteen inches. They are of the same coloration, however. The fur of the weasel is very valuable, especially when it is in the winter phase. The pure white fur is sold as Ermine.

The weasel emits a disagreeable odor when attacked, but it is less offensive and much less efficacious as a defense than that of the skunk.

The Least Weasel: Allegheny Weasel

Mustela allegheniensis

Although reputed to be quite scarce in Pennsylvania, the least weasel is probably much more common than is supposed. Its size and clever avoidance of traps, combined with its shy disposition and nocturnal habits, probably account for the fact that it does not figure largely among our native mammals.

Although the least weasel attains a length of seven inches, its body is extremely slender and its burrow can be plugged with the index finger of an adult. Frequently, the mice it kills have bodies so much thicker than its own that it cannot drag them into its burrow.

The habits of the least weasel are similar to those of other species. It feeds on mice, rabbits and birds. In the summer the upper parts of the animal, including the upper jaw, are dark yellowish-brown in color. The chin is white, while the under side, fore legs and under side of tail, are a deep ochraceous yellow. The terminal half of the tail on the upper side is of the body

Common Weasel—Winter Coloration

color and is tipped with black. However, there is only a very small tuft of blackish hairs on the extreme end of the tail. In winter the animal is entirely white, the transition from the summer to the winter coat being more rapid than the change that takes place in the spring. The least weasels are distinctly circumpolar in their distribution but are found in the northern hills of this State and have also been taken in the southwestern counties. The home is in an underground burrow and several litters of from five to six young are born during the year. The animal does not hibernate, but burrows in the snow, climbs trees, and ventures into the burrows of other animals, on its winter foraging expeditions. The anatomical features are similar to those of other weasels which have been previously discussed.

It is interesting to note that, in the far north, instead of having two or more litters during the year, the least weasel has only one litter of from ten to twelve young annually.

Bonaparte's Weasel *Mustela cicognanii cicognanii*

Bonaparte's Weasel

Mustela cicognanii cicognanii

This species, which inhabits the northern counties and mountainous sections of the southwestern part of the State, is apparently rather common. It may be distinguished from the common weasel by its relatively short tail, which is less than one-third the total length. This species is, as a whole, considerably smaller than the common form, attaining a total length of less than twelve inches.

The general color on the back is a bright chestnut brown, while the under parts, including the chin and throat, breast, under sides of the legs and the belly, are almost pure white, the colors meeting in a distinct line along the sides. The tail is tipped with black at all seasons.

NORTHERN MINK *Mustela vison vison*

In winter the animal becomes a pure white. As in all weasels, the male is considerably larger than the female, which is about two inches smaller than her mate.

Bonaparte's Weasel manifests the same predatory habits that characterize the weasel in general. It nests, rears its young, and exhibits a shyness characteristic of its larger cousin.

THE AMERICAN MINK

Mustela vison vison

The mink is related to both the otter and the weasel and emits a very offensive odor when attacked. Unlike the otter, the mink is more or less solitary in its habits, travelling about alone or in pairs.

The Mink is not a burrowing animal, but occupies the holes made by Muskrats and other burrowing forms. It lives in the vicinity of water, where it is quite at home, being a swift and agile swimmer. In the water the mink feeds on mussels, crayfish, and

fishes, which it captures with remarkable dexterity. It is not as aquatic as the Otter, however, and forages on land, feeding on rats, mice, muskrats, marsh birds and their eggs, rabbits, and, occasionally, poultry.

The mink is a very valuable fur-bearing animal and is much sought after by trappers, who have reduced its numbers considerably. The mating season begins in the early part of March and litters of from three to ten young are born in the latter part of April.

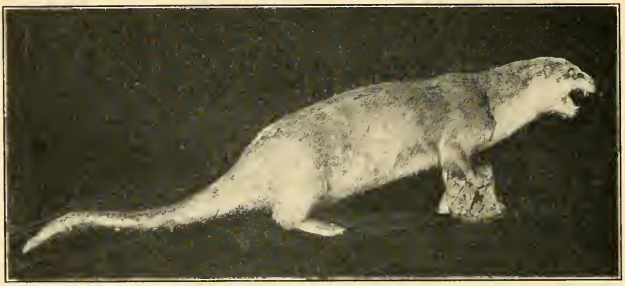
The animal attains a length of about twenty-four inches. The tail, which is quite bushy, is less than one-third the total length. The females are much smaller than the males, although they are similarly colored.

The general color is dark brown, becoming slightly paler beneath and with a whitish chin and throat. The outer hairs are long, harsh and somewhat glossy but the dense undercoat is short and soft. The body is somewhat similar to that of the weasel but the animal is heavier and much larger. The head is almost triangular in shape and the legs are very short. There are five toes on all feet, the soles of which are hairy, although the foot pads are naked. The ears are quite short.

Otter

Lutra canadensis

Although not as common as formerly, the otter is far from being exterminated in Pennsylvania. The otter is the largest native member of the weasel family (*mustelidae*). It is a very shy animal, living chiefly along the banks of lakes and streams, and is remarkably adapted to living in the water. Usually otters live in groups of from four to eight, placing their nests under



Otter *Lutra canadensis canadensis*

the roots of trees along the streams, or in the banks in much the same manner as do muskrats. They are short legged animals that do not migrate well on land. However, in the water they are extremely graceful and fast. They swim and dive with ease and are quite adept at catching fish, upon which they chiefly feed. They also eat frogs, crayfish and other aquatic animals and some writers state, that when hard pressed for food, they will feed upon eggs and poultry. In feeding, the food is held between the fore paws. Sometimes they make mud slides on a steep bank and several of them may play for hours, seemingly enjoying the fun of sliding into the water. Occasionally they make snow slides also.

The otter is a very wary animal and is seldom seen. It is apparently active both night and day. The otter attains a size of forty inches and its fur is very valuable. The body is long; the legs are short; the tail is rounded, being thick at the base and tapering; the head is broad and somewhat flattened, and the nose is short and blunt. The eyes are placed forward on the head and the animal is able to look around above water

without exposing its whole head. The color is a deep yellowish brown, becoming paler along the sides and blending to gray beneath. The outer hairs are hard and glossy while the under fur is dense and soft. The males and females are similar in color and there is no seasonal variation. The tail is more than a foot in length and the animal may weigh up to twenty pounds.

In the far north, the otter sometimes hibernates, but in Pennsylvania its tracks are to be seen in winter along most streams that have fish. The young are born in April and a litter contains, usually, from one to four little ones which remain with their mother until Fall.

The Skunk

Memphitis nigra

The common skunk or "polecat" is certainly one of the most beautiful of our native mammals. Its coat is black, with a broad white stripe down the middle of the back to the tip of the broad, bushy tail. This band is of varying widths in different animals and is sometimes very narrow, making the animal appear almost entirely black. There are two coats of hair on the Skunk, the outer coat being long and rather coarse, while the under fur is short and soft. The furs are much sought after, and bring good prices on the market, there being a demand for them in making garments for women, usually under the name of Hudson Sable.

But sometimes the most beautiful of creatures are disagreeable at times and when it chooses to be so, the Skunk can make things very unpleasant. Beneath the tail are two glands, one on either side, which are

SKUNK *Memphitis nigra*

equipped with an ejecting apparatus. From these glands the animal can shoot, for ten feet, a vile smelling fluid which is yellow in color and which is also capable of producing a burning sensation on the flesh. This has proved to be one of the most efficacious means of defense possessed by any animal. The skunk does not run from anything, generally because it does not have to. But sometimes such security dulls the intelligence of animals and the skunk has lost, or never had, the ability to discriminate among enemies. I have seen one stand in the path of an oncoming express train and raise its tail in defiance. Because of this inability to judge danger, thousands of skunks are killed each year by trains and automobiles. As a rule, the skunk will not use its weapons unless disturbed. But when irritated, it turns around, raises its tail, and "lets go."

However, no defense is impregnable and since they are nocturnal in their habits, many skunks fall victims to weasels, foxes and owls, especially to the great horned owl. The latter seems unaffected by the odorous fluid and frequently, specimens of these owls, sent to museums for mounting, reveal evidence of encounters with "the most aloof of our native beasts."

The home of the skunk is usually in a burrow in the woods. Sometimes it utilizes the burrow of some other animal, that of the woodchuck, for instance. Frequently, it occupies a hollow log or stone pile. The nest contains a bed of dried leaves and grasses and in the early Spring the female bears from twelve to eighteen young. The mother may be seen leading her offspring in a long procession, all in single file, across a field, as she goes on a foraging expedition at night. The young make excellent pets and manifest a real affection for someone who is kind to them.

While the skunk aids considerably in reducing the numbers of field mice, "grubs," grasshoppers, beetles and other insects, it occasionally invades the chicken coop and destroys numbers of baby chicks. Usually it takes just what it needs at the time, but it seems to remember the place and frequently returns at inervals until a whole brood has been taken. There is no doubt that the animal eats the eggs and young of ground nesting birds also, but on the whole, there is much evidence that shows the Skunk to be the farmer's friend.

The skunk is a little smaller than a house cat. The head is almost triangular; the tail bushy; the claws curved for digging; the ears short, and the soles of the

feet are naked, or nearly so. There are four claws on both the fore and hind feet.

The skunk partly hibernates during the winter but it does not enter a comatose state as do the woodchucks, for example. It is much less active in winter than in summer but it ventures forth at every mild break of the weather.

Foxes

The foxes are generally conceded to be the shrewdest of all our native mammals. Their ability to outwit dogs and human hunters shows a keenly developed animal intelligence. The term "sly old fox" is a complimentary recognition of their cunning. The manner in which foxes evade pursuers by doubling their tracks, wading in shallow water, and by leaping from one tree stump to another, wins the admiration of the fox hunter. Their habit of breaking the trail so that their pursuers cannot take it up again, or making it necessary to do considerable reconnoitering, enables the animal to frequently make its escape.

Economically, foxes are destructive. They destroy great numbers of quail, grouse, and other ground-nesting birds. They reduce the number of smaller game animals, and frequently they cause the loss of many dollars to farmers in a single night. I have seen, on several occasions, whole flocks of turkeys, ducks and chickens destroyed in a short time by these marauders. The fox does not seem content to kill a single fowl and devour it but will often slay, apparently for the joy of killing. Fowls perched on the lower branches of a tree and on high fences are not immune to danger from

Red Fox *Vulpes fulva*

foxes because they jump to amazing heights and one of our native species can climb.

On the other hand, while foxes destroy game and domestic animals, they render a certain amount of beneficial service by destroying field mice, rabbits and other pests. But the harm they do counterbalances the good and, under present conditions, it is expedient to consider our native foxes as economically destructive.

There are two species of foxes in Pennsylvania, both of them differing somewhat in size, color and habits, but the end results of their activities are similar. The fur of both the red and gray foxes is very valuable. The black and silver foxes are varieties of the red fox.

The Red Fox

Vulpes fulva

The red fox is generally distributed over the State, being common in even the southwestern counties, although it seems most numerous in the mountainous sections. It is larger than the gray fox and, unlike the latter, it does not climb. It is about three feet long and stands about thirteen inches high. The tail is more than a foot long and it uses it to good advantage when sleeping. The nose is bare, while the rest of the body is covered with fur. When the fox sleeps, it makes a bed of leaves and curls up, drawing its tail around itself and covering its snout. This prevents the nose from being frostbitten.

The red fox is considered the keener of our two species and its fur is the more valuable. From the author's observations, it seems to be more abundant than the gray fox, although the present bounty on the gray fox is higher than that paid for the red fox The red fox is more cunning, faster, and has more endurance than the gray fox.

The red fox does not climb trees and usually nests in an earthen burrow where it bears from five to ten young in early April. The male attends the female during the breeding season, which begins in February, and carries food to her until after the young have been born.

The red fox is a bright reddish yellow above and white underneath. The legs and feet are very dark, sometimes being almost black. The males and females are alike and there is no seasonal variation. The ears are erect and pointed, and the tail is tipped with white. There are five toes on the fore feet and four on the hind

Gray Fox *Urocyon cinereoargenteus cinereoargenteus*
Courtesy Carnegie Museum.

feet. The claws are long, sharp and not retractile. It is digitigrade.

The Gray Fox

Urocyon cinereoargenteus cinereoargenteus

The Gray Fox has a more southerly distribution than the Red Fox, but it has a general distribution in

the State. It can easily be distinguished from the Red Fox in its size, being slightly smaller, and by its color, which is an ashy gray above and a buff brown beneath. There are black facial and tail markings, and, on the sides of the neck, and across the chest there is a reddish-brown band. The throat is white and the middle of the ventral surface is almost white.

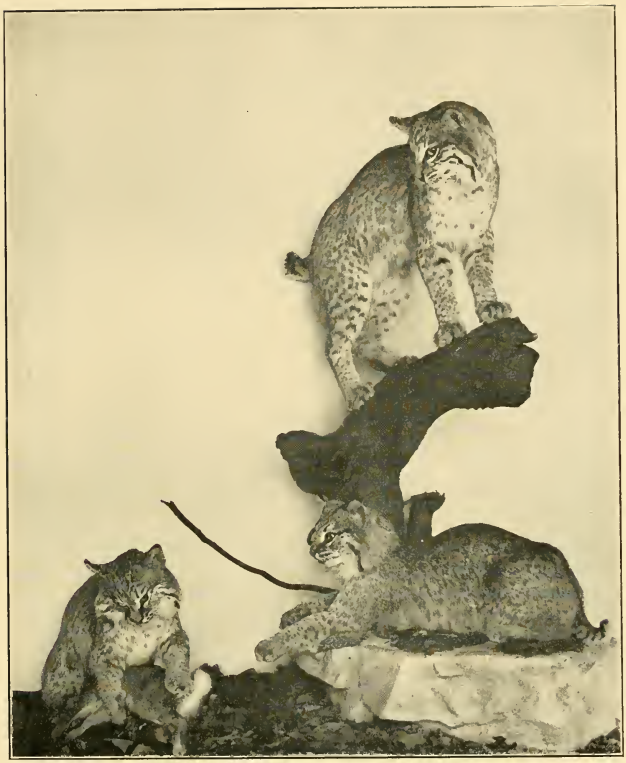
The gray fox has many habits similar to the red fox but it also shows some interesting differences. For instance, it does not run for many miles when pursued but usually takes to a tree or "holes up," after confusing its pursuers. For this reason fox hunters prefer the red fox for sporting purposes. Its habits of climbing trees adds to the dangers of nesting and roosting birds. It selects a hollow tree or rocky crevice for its home and the female bears only from four to five young, being less prolific than the red fox.

The nose is less pointed and the hair is coarser than in the latter species. Both the red and gray foxes are nocturnal and their foraging journeys lead them many miles from their burrows. The gray fox is said to jump from nine to ten feet above the ground and in this way it is able to capture domestic fowl which roosts on fences and on the lower branches of trees.

Wild Cat

Lynx ruffus

The wild cat is an inhabitant of the mountains, where it is becoming quite scarce. That it is far from being extinct is shown by the fact that the State Game Commission paid bounties on 615 of them in 1924. Many tales of the ferocity of this animal are told, but it is in reality a cowardly beast, retreating at the least



Wild Cat *Lynx rufus*

sign of danger. However, it is quite capable of putting up a good fight when slightly wounded or cornered.

The wild cat is mostly nocturnal in its habits, although it wanders frequently during the day, feeding on squirrels, rabbits, all kinds of birds and, especially, rats and mice. It is also reputed as a destroyer of deer.

While the creature is swift in its movements, it does not, as a rule, pursue its victims, as do foxes and weasels, but it generally lies in wait, crouching on the limb of a tree or on the ground among the bushes. When an unsuspecting animal comes within reach, the Wild Cat pounces upon it. Ofttimes, it utters a loud scream which startles other animals into activity, thus revealing their locations to the hunting cat.

The wild cat is a solitary animal and hunts alone or with its mate. It is most active during the early evening and morning hours and sleeps during the day in a cave or hollow tree. The nest is usually placed in the latter and is lined with soft mosses and grass. There are from two to four young born in the late Spring months.

The wild cat has a short bushy tail, long legs and large feet. The ears are rather prominent and tipped with black, but they are not conspicuously tufted. There is a ruff of hair on each side of the head. The males and females are alike and there is no change of color with the seasons.

The color is yellowish brown above, spotted on the sides with dark brown. There is a brown stripe on the forehead and one on the back and tail. The under parts are a creamy white, with black spots. The fur is dense and soft.

The creature is much larger than a common house cat, reaching three feet in length, while the tail is only about seven inches. It is most common in the northern and central counties.

Woodchuck *Marmota monax monax*

The Wood-Chuck: Ground-Hog

Marmota monax monax

The wood-chuck or ground-hog is one of the most widely distributed of the Pennsylvania mammals. It is a rather large, heavy-bodied, short-tailed, terrestrial form, with a blunt nose, large rounded head and comparatively short ears. The short legs make the body appear to be rather robust. The fore feet have four well-developed toes and the animal uses these to good advantage in digging. The hind feet are equipped with five toes. The color is usually a mottled grey with a brownish tint, the males and females being alike. The wood-chuck is a sluggish and somewhat stupid animal and, as a rule, it does not venture far from its burrow. When danger approaches it raises itself on its hind legs, looks about and immediately "make for home." While it is occasionally a solitary animal, the ground-hogs usually live in colonies and the entrances to a number of burrows are usually grouped within a

rather limited space, preferably on the slope of a meadow. Each burrow usually has a number of exits, in order to make escape more certain when the animal is pursued. In close quarters, the ground-hog chatters its teeth and utters a low whistling sound. It is chiefly diurnal in its habits and forages in the woods and in the thick growth around the borders of fields, feeding on grasses, clover and, occasionally, garden crops. Because of its habit of placing the rather large burrow, around the entrance of which it heaps mounds of dirt, in sections where horses and cattle graze, the animal becomes somewhat of a nuisance. Farmers insist that running stock is endangered to the extent of breaking their legs by stepping into the exposed entrances of the burrow. For this reason, and because of the fact that it sometimes becomes quite destructive in truck patches, farmers wage an incessant war against it. The ground-hog eats voraciously during the summer and builds up a large reserve of fat to carry it over the winter. Instead of storing up food materials, as do its relatives, the squirrels, the ground-hog hibernates. At the first approach of frosty weather, the ground-hogs enter their burrows, where they remain inactive until the following Spring. As a general rule, they hibernate in pairs, snuggling together and sleeping through the long winter months. Because of the inactivity, they require little food, and the energy is supplied by the excess of fat stored up in the Summer months. The ground-hog attains a length of about twenty to twenty-five inches. Its tail is about six inches long and a large animal may weigh as much as twelve or thirteen pounds. There is a common superstition that the ground-hog emerges from its winter sleep about the first of February and ventures forth from its bur-

row. The legend states that, if the sun is shining and the animal sees its shadow, there will be a continuation of extremely cold weather for six weeks. On the other hand, if the day is dark, the creature does not see its shadow and this is supposed to be an omen of the beginning of mild weather. However, the ground-hog does not emerge from its burrow until the Spring vegetation has come to life. After a long Winter's sleep, the animal is lean and demands an immediate food supply. In a normal season the female bears from three to eight young in the latter part of April and, ofttimes, when the mother is away on a foraging expedition of her own, the young may be seen playing about the entrance of the burrow. The fur of the ground-hog, being rather coarse, has no commercial value and, while its flesh is relished by some people, it is not generally utilized as a food. Lacking these two qualities, it is not generally sought after by hunters and trappers and it has therefore been able to multiply in great numbers. Its chief enemies are dogs, weasels and, occasionally, foxes.

The Eastern Chipmunk

Tasmias striatus striatus

The chipmunk is a splendid example of how certain forms increase in numbers when man is eliminated from their list of enemies. While it is virtually a small edition of a tree squirrel and is probably just as edible, it is so small, fortunately, that hunters do not molest it as a rule. Consequently, chipmunks abound in great numbers and are familiar sights to almost every boy and girl. The fact that they are gazed upon in a friendly way, by humans, has caused them to exercise little concern over the presence of a human in their haunts.

CHIPMUNK *Tasmias striatus striatus*

They are friendly creatures and even the wild form can be cultivated by overtures which are not too aggressive. They are usually seen in rocky places where they intelligently place the entrances to their underground burrows under stones or in other concealed places. Unlike the ground-hog, the chipmunk is very careful not to advertise the location of its home by heaping mounds of earth around its doorway, or by establishing beaten paths which lead directly to it. The exterior of the home shows a single tunnel, but a short distance from the surface of the ground, there may be several channels running in various directions and, like the wood-chuck, the animal is careful to provide more than one exit for escape, in case of necessity. Sometimes the original opening is closed and one of the exits is transformed into a "front door." Just how the animal disposes of the dirt, which is removed in the making of its home, is still a matter of uncertainty, but

it undoubtedly takes every precaution to avoid making the location of the burrow conspicuous. The chipmunk feeds largely upon seeds, grain and nuts, and he is often accused of destroying the eggs and young of ground-nesting birds. The stomach contents of several specimens revealed insects and the remains of some small mammals, probably mice. The chipmunk stores up a large winter supply of food and during the late summer months, it may be seen busily engaged stuffing beechnuts and other small fruits into the pouches on either side of the face. The color of the chipmunk is a rusty brown, with an occasional tint of gray. There are five black stripes and two white stripes along the back from the shoulders nearly to the tail. The under side is whitish, and the tail is usually darker on the upper surfaces, showing a yellow fringe along the side. The tail is broad, flat and moderately bushy and is only half as long as the body. The head is rounded; the ears are short, but prominent, and clothed with short hairs; the body is trim but not slender; the general coat is short and soft. There is no difference between the sexes and only a slight seasonal variation in the color.

Gray Squirrel: Black Squirrel

Sciurus carolinensis leucotis

The Eastern Gray Squirrel *(Sciurus carolinensis carolinensis)* has a wide distribution in Pennsylvania. Its home is usually found in a birch, maple, or beech tree, the entrance being high above the ground. In summer it will often build an outside house of sticks, bark, and leaves, lining it with mosses and grasses. It is placed among the smaller branches and has the appearance of a crow's nest from the ground.

GRAY SQUIRREL *Sciurus carolinensis leucotis*

The gray squirrel does not hibernate and therefore, does not lay up a store of nuts, etc., for winter use, although it does bury acorns and nuts in the ground or hides them in crevices in trees. The ease with which gray squirrels become tamed is shown by the numbers in city parks, where they do not hesitate to search one's person for food.

The gray squirrels are represented by two subspecies in Pennsylvania, the eastern gray squirrel (Scirurus carolinensis carolinensis) which is generally distributed, and the northern gray squirrel (Scirurus carolinensis leucotis) which is found only in the northern part of the State. The former is a dark yellowish rusty brown above, with the hairs on the tail yellow at their bases, then black, and tipped with white. The under parts are whitish; the ears are yellowish and

BLACK SQUIRREL *Sciurus carolinensis leucotis*

hairy; the tail is about half the length of the body and quite bushy; and the length is eighteen inches.

The latter is larger and grayer. The black squirrel is a variety of the gray squirrel, and it is more generally of this species.

Fox Squirrel *Sciurus niger*

The gray squirrels are valuable for their fur and as game. Their enemies are hawks, mice, foxes, red squirrels. There are usually five young in a litter.

Fox Squirrel: Yellow Bellied Fox Squirrel

Sciurus niger rufiventer

The fox squirrel is the largest of our squirrels and is less generally distributed over the State. There are probably two species of fox squirrels in Pennsylvania. The largest species *(Sciurus niger)* varies from a glossy black to a clay color mingled with black above and a whitish gray beneath. The nose and ears are white, while the top of the head is black.

The body is large and heavy and the ears are moderately long. The tail is an admixture of black and yellowish and is approximately one-half the body

length. This species is indigenous to the eastern and southeastern sections.

The more common species *(Sciurus niger rufiventer)* is not so large as the one above and is less variable in coloration. The ears and nose are never white. The under parts are always rufous yellow. This species has a total length of about twenty-three inches. It feeds on nuts, seeds, birds and fruit.

The yellow bellied fox squirrel is well distributed in western Pennsylvania, but it is not at all common.

Red Squirrel (Southern)

Sciurus hudsonicus loquax

The red squirrel is the sauciest, most active and most curious of the Pennsylvania squirrel group. There are many species of red squirrels, and the number in the State is a matter of some controversy. Inasmuch as there is a wide variation in the color of the pelage of even a single species, it is difficult to determine whether some of them are true species, subspecies, or only varieties. There are three possible species within the confines of the State. The assumption is based on our knowledge of the geographical distribution of the various kinds. The three that may possibly exist here are: The eastern red squirrel, or chickaree (Sciurus hudsonicus husonicus), the southern red squirrel (Sciurus hudsonicus loquax), and the little red squirrel (Sciurus hudsonicus gymnicus). The first is supposed to be confined to the Canadian section but it seems to have migrated southward and is reported from the north central counties of Pennsylvania. The second is supposed to be the commonest species

Southern Red Squirrel *Sciurus hudsonicus loquax*

(or subspecies), ranging from Ontario to the Carolinas. The third is reported from the North with northern New York as its most southerly limit, but there is also some evidence that it is to be found in the northern section of Pennsylvania. The differentiation of these species, or rather subspecies, is not an easy task.

The habits of all are similar and it is not difficult to cultivate the friendship of the common red squirrel. On a camping trip as we sat down to breakfast under some pine trees, a red squirrel became quite curious and sat on a branch above us, chattering away for dear life. A few days later he ventured down the tree and inspected some packages on the other end of our long table, helping himself to rolled oats which were in a cardboard box. After that we were visited

each morning and as we ate the squirrel proceeded to fill himself with rolled oats, which we always placed there for him. On one occasion he came to the middle of the table and looked over our breakfast menu. Evidently not liking the looks of our trout and flapjacks, he returned to the other end of the table and disappeared in the box of oats. Within ten days he would come and feed from our hands. Although accused of destroying the nests, eggs and young of birds, as well as exterminating the gray squirrel, there is considerable evidence to show that the damage done by the red squirrel is over-estimated. The diet usually consists of nuts, berries, fruits, pine seeds and fungi, although there are occasional cases in which other animals are eaten. Quite frequently, blue jays and rodents rob him of his winter supply of food when he is careless enough to store it in accessible places. John Burroughs pays tribute to the cleverness which the red squirrel employs in gnawing butter nuts on the side where the kernel is exposed and where less labor is necessary to reach it.

The red squirrel seems to prefer coniferous woods and is sometimes called the Pine Squirrel. It nests in a hollow tree or under the roots. In summer it builds an outside home high above the ground. This nest is irregular in shape and is composed of leaves and vines. It resembles an old crow's nest. In fact, the red squirrel often modifies old nests and utilizes them for summer nests. It is said that he is quite fond of maple syrup and he is accused of tapping sugar trees.

While it is somewhat of a nuisance in that it does not tolerate other squirrels in its domain, it is undoubtedly the most interesting of the group.

The common chickaree is not more than twelve inches long. Its fur is short and soft, covering the whole body including the feet. It is yellowish brown above in summer and in winter it is more of a chestnut color. The under side is whitish with an olive tint on the sides. The head is somewhat blunt and rounded. The ears are large and hairy. The tail is as long as the head and body.

On the southern red squirrel the tail is longer; there is a noticeable dorsal stripe; and the animal is larger as a whole. The little red squirrel is much smaller and the tail has an orange-red fringe on the sides. The fur is an important article of commerce.

Eastern Flying Squirrel

Glaucomys volans volans

The flying squirrel is so named because of its ability to glide gracefully from heights and land easily on the ground or on the lower limbs of trees. It possesses a peculiar hair-covered membrane of skin on both sides of the body between the front and hind limbs. The skin flap is attached to both limbs as far as the wrist and ankle, and when the animal is ready to "fly" the legs are extended and the membrane spreads like a sail. The creature then soars through the air in a volplaning sort of flight. The strong hind legs enable the animal to "take off" with a force that carries it to a great distance. The tail, which is thin and flat, is turned upwards as the animal alights and thus makes the landing easy. The stretched membrane serves the same purpose as the wings on an airplane.

In color, the flying squirrel is grayish brown, with a rusty tinge above and underneath it is white.

Eastern Flying Squirrel *Glaucomys volans volans*

The skin flaps on the sides are of a dark brown. The head is blunt and rounded and the ears are short. The tail is about as long as the head and body together. The hair is soft and of medium length.

The creature makes its nest in a tall tree and lines it with dried leaves. As a rule, flying squirrels live in

communities and a number may live together in a hollow tree. However, each pair usually stores up their own winter supply of food which is concealed in another tree from the one in which the nest is placed. There are usually from three to seven young.

The flying squirrel is a nocturnal animal and it possesses large glowing eyes. It is omnivorous and eats nuts, insects and birds' eggs. There is also some evidence to indicate that it will, occasionally, eat young birds. The animal is easily tamed and makes an excellent pet, but it avoids bright light, and will crawl under one's coat or into his pocket to avoid it. A full grown animal may attain a length of 10 or 12 inches. The males and females are alike and there is little seasonal variation.

Beaver

Castor canadensis

The beaver is one of the rarest and most interesting of our native mammals. Its spectacular habits reveal some remarkable adaptations. It is a swimmer, woodsman and engineer.

The hind feet are webbed for swimming and the long, broad, flattened tail is used as a rudder. The great incisors, characteristic of the rodents, serve admirably in felling trees, and the endurable homes and dams show a practical knowledge of construction on the part of the animal.

The beaver is entirely herbivorous and feeds on the bark of many trees. It is especially fond of the bark and twigs of the yellow birch, quaking aspen, poplar and willow. Selecting trees of these species which grow close to the water, the beaver gnaws around the trunk

BEAVER *Castor canadensis canadensis*

near the ground until the tree falls. The branches are then removed and ofttimes the main stem of the tree is cut into shorter lengths, so that they may be pushed, dragged, or rolled into the water.

In making the dam, the beaver selects a small woodland stream. Placing the longer and thicker stems and branches with their large ends up stream, the animal proceeds to carry mud and stones which are piled on the bases. Then the smaller sticks, grasses and green branches are woven together and the crevices are filled with mud and stones. The process of construction goes on until the dam is from four to six feet high. The water backs up and forms a good sized pond of comparatively still water. In this pond water lilies and other aquatic plants grow and the beaver feeds on the roots of these. When the trees along the water's edge have all been cut down, as happens when the colony is an old one, the beaver will frequently dig canals from the pond back to the woods. In these canals food is transported and the necessity of dragging sticks and branches from a great distance over land is eliminated.

Usually there are supplementary dams placed above and below the main one to reduce the danger of breaking in rainy weather when the streams are swift. The dam below the main dam holds the water against the lower side of the latter and strengthens it.

There are generally a number of beavers in a colony and when a break occurs in the dam, all of the members set to work to repair it. Each animal secures a stick on the shore and immediately swims with it to the break, where it is carefully placed. The sticks are placed so that water flows through them and floating material is caught as in a sieve and helps to plug the opening in the dam.

The beaver often lives in burrows in the banks of the pond. These burrows extend for a considerable distance beneath the bank and generally have their openings below the surface of the water. The burrow ends in a larger chamber several feet in diameter.

Usually the beaver constructs a mound-like home out in the water. This is made of sticks and mud and varies in size according to the number of individuals that live in it. The mound is conical and may be as much as eight feet high and forty feet in circumference. Inside the house and above the level of the water is a chamber in which the animal lives. The entrance to the hut is through a tunnel, opening beneath the surface of the water. The walls of the house are quite thick.

In winter the beaver partly hibernates within its house but ventures forth in mild weather. Food is stored in the pond for winter use and the sticks from which the bark has been gnawed are used in reenforcing the dams.

The beaver is active day and night and when swimming it slaps the water violently with its tail to warn others when danger approaches. It is also interesting to note that when a Beaver is cutting down a tree, it invariably strikes the ground with its tail as a warning to others in the vicinity, when the tree is about to fall.

The beaver is the largest of the rodents and may weigh up to fifty pounds. Its color is a dark chesnut brown on the back, blending to a lighter, almost cinnamon, brown beneath and on the sides.

The head is rounded and the nose is blunt. The large orange colored incisors are quite prominent. The ears are short and the body is thick and heavy set. The legs are short and each foot has five toes. The second toe on the webbed hind feet has a double or divided claw. The beaver has anal musk glands which secrete a strong-smelling fluid. There are two coats of hair, the outer being longer and coarser than the soft under fur. Both the females and the males are alike and there is only a slight seasonal variation.

The total length of an adult beaver is about forty-two inches. The tail is about sixteen inches long and the hind feet measure almost seven inches.

Beavers are apparently monogamists and probably mate for life. Mating takes place in February and the young, numbering from three to eight, are born in May.

At the present time beavers are quite scarce, although a splendid colony thrives in Potter County. The beaver is fully protected by the game laws of Pennsylvania, and it is to be hoped that its numbers will

White Footed Mouse *Peromyscus maniculatus maniculatus*

increase. Recent reports show a rather rapid spread and there are at least five colonies of Beavers in the State at the present time.

Deer Mouse: White Footed Mouse

Peromyscus maniculatus maniculatus

The deer mouse or white footed mouse, is one of the commonest and gentlest of wild creatures to be found in this commonwealth. One can see it at most any season in the woods and around barns and brush heaps.

Is is undoubtedly the most beautiful of all our native mice, being grayish brown above and almost pure white beneath. It is larger than the house mouse and has a long pointed nose. The ears are large, hairy, and prominent. The large eyes and long whiskers make its face attractive. As a rule, it may be handled with impunity and within a few days it becomes as tame as white mice.

Cloudland Deer Mouse *Peromyscus maniculatus nubiterrae*

The home of this delightful creature is usually in the woods where it may add to a deserted bird's nest, making of it a large globular house of dried leaves, grasses and vines, sometimes a considerable distance above the ground. It frequently happens that a number will occupy the same nest. Rural dwellings and barns are also utilized for home making.

The deer mouse feeds upon seeds, nuts and grains. Sometimes it stores large quantities of beechnuts, acorns, seeds and corn, for winter use. Summer camps are invariably visited by the deer mouse and cereals, flour, and sometimes hide shoestrings, are destroyed by it. It is an excellent climber and runs about over the branches of trees and shrubs. Some people call it the wood mouse.

This interesting creature is very prolific and the female may have three or four litters of from three to six young in a year. On one occasion the writer sur-

prised a number of deer mice in a rather open place. Three of them darted under a board. When the board was lifted, all three had their noses pushed into a shallow cavity which they had evidently dug in a hurry. Remaining absolutely quiet, they apparently thought they were escaping detection although their bodies were fully exposed. Needless to say, they were not further disturbed.

According to some writers, the deer mouse resorts to "singing" for its own amusement or perhaps for its mate. Who knows?

Fischer's Deer Mouse

Peromyscus leucopus noveboracensis

Another species of deer mouse to be found within the confines of Pennsylvania and inhabiting only the forest regions of the mountains, is Fischer's deer mouse. This species is more grayish than Rafinesque's species and there is a greater number of dark tipped hairs on the back which detract somewhat from the clearness of the dorsal band or broad stripe that is so evident in the latter species.

Fischer's deer mouse is not so common and is generally found in the higher evergreen forests. It is the same size as Rafinesque's deer mouse and has a total length of six and five-eighths inches. The tail is almost three inches long.

Cloudland Deer Mouse

Peromyscus maniculatus nubiterrae

The cloudland deer mouse is found only in the highest mountainous regions of Pennsylvania. It is a

dull smoky brown color above and is considerably less white underneath than the common deer mouse.

The tail is slightly longer than the head and body combined and it is quite hairy, ending with a tuft of hair at the tip. The animal attains a length of seven inches, the tail totalling three and three-fourths inches.

Rafinesque's Deer Mouse

Peromyscus leucopus leucopus

The color of this species is much more striking than that of the cloudland deer mouse. In this species the dorsal surface is a dark or bright rusty brown like that of a deer and the undersides are more nearly white. There is a well-defined dorsal stripe of gray and black-tipped hairs extending from the neck to the base of the tail. The tail is considerably shorter than that of the cloudland deer mouse.

Refinesque's deer mouse is also a good climber and occupies old birds' nests and hollow trees. It manifests a behavior similar to the common deer mouse but confines its activities to woodland areas. It is just about as large as the common deer mouse.

House Mouse

Mus musculus

This clever creature is to be found everywhere in abundance. Like the rat, it seems to prefer an intimate association with humans and only its size prevents it from doing as much damage as the rat.

However, it succeeds in doing quite enough harm and should be continuously fought against. In addition to adding to the terrors of the female human popula-

tion, the mouse persists in destroying foodstuffs and other materials in much the same manner as do rats.

Being of small size it gains access to many situations and even the seed in the canary's cage is devoured by it. Of course, field mice frequently get into the house also, but in cities it is invariably the house mouse that one sees and hears. The house mouse nests in fur garments, old shoes, stove pipes, rag bags, and in almost every other sort of locality. It begins to bear when three months old and has a litter of from eight to ten every two or three months during the year. The nest is made of soft materials, such as hair, chewed newspapers and rags.

The house mouse, I believe, is the fastest mouse in the world. I once had a mouse cage with a pivoted disc placed at a slight incline. The mice would run on this until it revolved at a great speed. It worked in the same manner as a treadmill. When I placed house mice in the same cage with field mice the former rotated the disc so rapidly that the field mice could not keep up the pace and they were thrown off the disc by centrifugal force. The house mouse invariably ate the young field mice, and later when the young were finished, they would gradually kill off all of the adult field mice.

The chief characteristics of the house mouse are: nose pointed; ears fairly large; tail quite long; body almost slender; color above, grayish brown with long black or yellowish hairs unevenly distributed; the under side is a slaty gray. Seldom more than six inches long, the tail being half the body length.

The Lemming Mouse: Cooper's Lemming Mouse

Synaptomys Cooperi

The lemming mouse is found in boggy regions at a few places in the State. It often uses the runways of meadow mice and is frequently caught with them. It resembles the meadow mouse so closely that it is apt to be mistaken for it. The lemming mouse may be distinguished by its short tail and by its grooved front teeth. The head is blunt; the ears are nearly hidden in the fur, and the legs are short. Its coloration is virtually the same as that of the meadow mouse and the two sexes are alike. There is a slight seasonal variation, the summer color being a buffy gray or yellowish brown lined with black, and the winter color being a slaty gray. It is about five inches long when full grown.

Red Backed Mouse: Red Backed Vole

Evotomys gapperi gapperi

Although usually preferring forest haunts, the red backed mouse is frequently to be found in grassy fields where it hides under fallen logs or under stones. It really lives in underground burrows similar to those of field mice but usually selects dry, well-drained ground. Its nest is made of fine dry grass or moss and is placed within a chamber along one of its underground tunnels. Sometimes it nests in a hollow log and, on one occasion, I found a number of nests under a slab of corrugated iron. Several litters of young are born during the summer and each litter may contain from three to eight young.

The red backed mouse is related to the field mice, but it seldom menaces crops as do the latter at times. The distribution of this form in Pennsylvania is some-

Red Backed Mouse *Evotomys gapperi gapperi*

what limited to the mountains and the counties bordering on them, although it has been reported from Cook Forest.

It is active both day and night and one may see it sitting up like a squirrel, holding seeds of berries between its fore feet and nibbling away in a characteristic manner. It eats beechnuts, acorns and other seeds, in addition to young roots, bark and twigs of low shrubs.

Northern Pine Vole: Mole Mouse

Pitymys pinetorus scalopsoides

The pine vole is an inhabitant of the southern section of Pennsylvania, occurring in the southwestern and southeastern counties.

It is called the mole mouse because of its burrowing habits. It lives almost entirely beneath the surface of the ground and has its fore feet somewhat modified for digging. The pine vole confines its activities

to comparatively loose soil where it makes a series of tunnels which ramify in all directions. It frequently follows corn rows and removes newly-planted seeds. Occasionally it enters gardens and takes beans and other seeds. In addition, it does considerable damage to bulbs and the roots of growing plants. It is particularly destructive to sweet potatoes and tap roots.

The pine vole is covered with a soft, dense fur, which resembles the coat of the Mole in texture. The general coloration is rusty brown above and the under parts are whitish. The ears are short and inconspicuous and the eyes are small. The tail is very short, totalling only about one-fifth the body length. The legs are short and in some ways the animal resembles a shrew, but the rounded head, blunt nose, and typical rodent teeth, enable one to easily identify it.

The pine vole nests in a globular mass of dried leaves and grasses placed in an enlarged chamber along one of the subterranean tunnels. There are usually from four to six young in a litter. These are born in the latter part of March or in the early part of April. There are probably five or six broods in a year.

The Meadow Mouse

Microtus pennsylvanicus

The meadow mouse is abundant in all parts of Pennsylvania and, with its relatives, is probably the most abundant rodent in numbers and species on the North American Continent. While our common species prefers moist meadows and swampy fields for its home, it frequently extends its burrows into cultivated fields. Occasionally it constructs a summer nest under a log or in a tussock of grass. While it sometimes bears its

MEADOW MOUSE *Microtus pennsylvanicus pennsylvanicus*

young in the nest above ground, as a general rule, it has a chamber at the end of the underground burrow where four litters of from six to eight young are born during the year. The underground home is bedded with soft materials of all kinds. It rarely nests in houses or barns.

The meadow mouse establishes a series of runways which ramify in all directions from the entrance to the burrow. The runways are kept clear of sticks and other obstacles, which might impede its progress in case of a hasty retreat to the burrow is made necessary.

The meadow mouse feeds on growing grass, alfalfa, seeds, bulbs, root crops and vegetables. When wheat and oats are harvested, great numbers of meadow mice congregate under the shocks and frequently do great damage. In the winter they often gnaw the bark around the bases of young fruit trees and whole

orchards of young trees have been killed by them. It is estimated that the mice of the Genus Microtus cause an annual loss of over three million dollars to American farmers.

The meadow mouse is about seven inches long and the tail is not quite two inches in length. The body is somewhat heavier than that of the house mouse. The head is large and blunt; the ears are barely perceptible above the fur; legs are short, the fur is long, and overlaid with coarse hairs; the soles of the feet are naked and each foot has six plantar tubercles.

The sexes are identical in size and color. The summer coat varies from a dark chestnut brown to a light yellowish brown above, with a number of coarse black hairs along the back. The under parts are a smoky gray slightly tinged with light brown. The feet are brownish. The tail is brown above and somewhat paler beneath. In winter the general coloration is duller and more uniformly gray.

The Meadow Jumping Mouse: Kangaroo Mouse

Zapus hudsonius americanus

This interesting creature may be readily identified by its extremely long hind legs; very long tail, which is one and one-half times the body length; short fore legs; and cheek pouches into which it can stuff considerable food.

It is yellowish brown in color and has a very perceptible black band running down the middle of the back due to the presence of many long, shining black-tipped hairs. The sides are even a brighter hue and the under sides and feet are white. The dividing line between the upper and the under sides is sharply

MEADOW JUMPING MOUSE *Zapus hudsonicus hudsonicus*

drawn. The tail is dark above and whitish beneath and is sparsely covered with hair. The head is of normal proportions and the nose is pointed. The ears are small and each foot has five toes.

The hair coat may seem rather coarse upon the first examination, but a closer observation will show that the main coat is short and fine and that the coarser long hairs are less in number.

The jumping mouse is well named and it leaps in a manner similar to the kangaroo after which it is also named. The tail serves as a prop and aids considerably in locomotion, as is shown by the fact that when part of the tail is lost through accident, the animal has considerable difficulty in getting along.

The jumping mouse is a very inoffensive creature and feeds upon green vegetation, although it seldom becomes a menace in hay fields. It nests in a shallow burrow, in hollow trees or beneath boards. The

Woodland Jumping Mouse *Napaeozapus insignis insignis*

nest is globular and occasionally made of dried grass. The young are born in litters of five or six during the latter part of May or in the early part of June. In winter the animal digs a deep burrow in which it hibernates. Its total length is about eight inches and the tail is about five inches. The hind foot measures 1.2 inches.

Barton's Jumping Mouse: Eastern Meadow Jumping Mouse

Zapus hunsonius americanus

The common meadow jumping mouse has a very closely related species which is to be found in the southeastern and southwestern sections of the State. Like the common form, it may be readily distinguished by its long hind legs and very long tail. The chief means of locomotion is by a series of "kangaroo leaps" which may be as long as eight feet.

All species of jumping mice have summer homes and winter homes and breed from May until September when they prepare for hibernation.

The summer homes are above the surface of the ground and the winter homes are in underground shelters. Barton's jumping mouse is slightly larger than the common meadow form and is a dusky brown, tinged with a reddish buff on the back. The sides are reddish buff and the under parts are almost pure white. The dark dorsal stripe is less prominent than in the meadow jumping mouse.

Woodland Jumping Mouse

Napaeozapus insignis insignis Miller

Like the meadow jumping mouse, the woodland form has a very long naked tail which it uses to good advantage in its jumping movements. However, this species is larger than the other species of jumping mice and its ears are larger and longer. The woodland form has a paler color, becoming almost a buffy yellow above and does not have an admixture of brownish gray on the under parts. The tail is tipped with white. There is also a distinct dental difference in that the woodland jumping mouse lacks the upper pre-molar tooth which is possessed by the other Jumping mice of the Genus Zapus.

The woodland jumping mouse lives within the confines of the forests, in close proximity to a stream. The creature forages along the banks and its footprints are commonly seen in the moist sand close to the water's edge. It is supposed to be entirely a nocturnal animal and it is the most beautiful of the group of kangaroo mice. None of the jumping mice become pests inasmuch as they limit their diet to small seeds, nuts, grasses and insects.

Brown Rat: House Rat *Rattus norvegicus*

As winter approaches, the jumping mouse retires to a spherical nest of leaves and grass which is placed below the frost line. In the nest the creature curls up and sleeps until Spring returns.

The House Rat: Norway Rat: Brown Rat: Gray Rat: Wharf Rat: Barn Rat

Rattus norvegicus

Certainly the common rat is the most detested of native animals. The damage done by it amounts to millions of dollars annually and it seems that nothing escapes its destructive ravages. Every sort of foodstuff, flooring, hot house plants, hulls of ships, insulation on electric wires, lead pipes, books, clothes, grains, field crops, chickens, birds' eggs, and even little pigs, are destroyed by it. In addition to causing great damage to these and other things, the rat spreads fleas, filth and disease. It is very prolific, having several litters of from eight to fourteen young each year. The common rat is not a native of the United States, but was introduced years ago, having been brought here in ships. It is now quite generally distributed over the world

and in some countries causes a great mortality through its spreading of bubonic plague, tuberculosis, parasitic worms, typhoid and other maladies.

It is a vicious creature and can inflict severe injuries. It nests in sewers, mines, and in the habitations of man. Sometimes it burrows in the ground and its burrowing has been known to reduce the strength of building foundations.

It lines its nest with rags, cotton or any other soft material which it can find or steal. It is normally a grayish-brown color on the upper part of its body and a grayish white below. Its ears and eyes are large and its tail is as long as the head and body. The tail is almost naked, and the rings of overlapping scales are quite visible. It is about fifteen inches long when full grown. The snout is long, pointed and bare at the end.

Black Rat

Rattus rattus rattus

The black rat was probably introduced before the common brown rat but its numbers have been considerably reduced by the latter. In fact, the black rat has been completely exterminated in some sections by the brown rat. There is some claim that in Pennsylvania the black rat has been completely eliminated from the fauna but this is entirely erroneous.

One evening a friend and I, while walking along a street in a Westmoreland County town, noticed a rat in the window of a well-kept meat and delicatessen shop. Stopping to examine it, we were surprised to find that it was unmistakably the black rat. Since that time I have seen it in three other localities. The black rat is smaller than the Norway or brown rat, and on

Black Rat *Rattus rattus rattus*

the dorsal surface it is a rather lead-colored black. The ventral surface is a slate-colored black. In addition to the difference in color, the tail of the black rat is much longer in proportion than that of the brown rat and the scaly rings on the tail are even more prominent in the black rat than in the brown rat.

The habits of the black rat are similar to those of the brown rat except that it does not burrow under foundations.

Another rat that may be found in Pennsylvania in scattered localities and in reduced numbers, is the roof rat or Alexandria rat *(Epimys rattus alexandrinus Geoffroy)*. It is smaller than the brown rat and proximates the size of the black rat. Its tail is more than half the body length while the color is reddish brown above, blending into a grayish white below. It is apparently scarce.

Wood or Cave Rat

Neotoma Pennsylvanica

The Pennsylvania woodrat is most common in the mountainous counties of the State where it lives in

Wood Rat or Allegheny Cave Rat *Neotoma pennsylvanica*
(From Rhoads' "Mammals of Penna. and New Jersey")

caves or in rocky crevices. Occasionally it burrows into the ground under the stump of a dead tree. The nest is usually conspicuous because of its habit of placing all sorts of objects about the entrance. Virtually, every mountain cabin is inhabited by this curious creature which seems to take delight in stealing objects which could not possibly serve it in any way. Knives, forks, spoons, nails and dozens of other articles, left lying about a hunting lodge, or cabin, will disappear and a careful search will reveal them to be hidden in all sorts of places. Dr. Hornaday says that "Seemingly, its chief object in life is to play practical jokes on mankind." One writer had his watch carried away by the woodrat and recovered it in a nest the following season. On one occasion the writer, while camping in a mountain bungalow, was awakened by a scraping noise. A flashlight exposed a woodrat dragging one of his bedroom slippers across the floor.

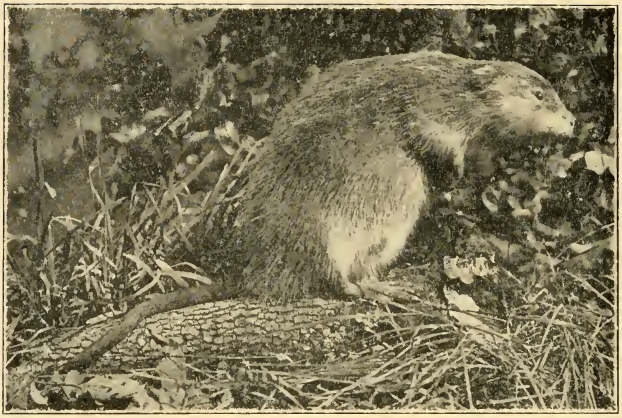
Mr. George W. Gordon states that in a small cave in Fayette County he heard a noise beside him and his flashlight revealed a woodrat within twenty inches of the lamp. The creature was sitting on its haunches carefully gnawing the bark from a small twig. When it had finished it proceeded nonchalantly to wash its face, not paying any attention whatever to the bright light.

The woodrat is about the size of the ordinary house rat but it is easily distinguished from this loathesome species by its buffy slate-colored back and white under parts. Its tail, unlike that of the brown rat, is quite hairy and sometimes bushy. The under side of the tail is white. The eyes are large and black and the ears are large and prominent. The long pointed nose and long white whiskers add a touch of dignity.

The nests are placed in every sort of location, on an old cupboard, in a cave and in unused houses; sometimes the nest is placed in the middle of the floor. The nest is a huge affair, usually mound-like and constructed of sticks, tufted seeds, rags, etc., crudely heaped together. The animal stores up quantities of seeds, pinyon and other nuts, haws, wild grapes and other fruits.

The woodrat is chiefly nocturnal and is a good climber. While it is usually solitary, several may occupy the same nest. There are several litters of four or five young each year.

In some sections of the United States, and especially in Mexico, the woodrat is relished as a food. It is seldom a troublesome creature here, although it has been known to dig up pine seeds that have been planted.



MUSKRAT *Ondatra zibethica zibethica*

THE COMMON MUSKRAT

Fiber Zibethicus

The muskrat is quite generally distributed over the State and is sought by many persons for its valuable fur. It is several times as large as an ordinary rat and has a rather thick body with short legs. The hind feet are partly webbed and otherwise adapted to swimming.

The long, scaly, nearly naked tail is flattened on the sides and serves as a rudder when the animal is swimming. The color is brown, but of various shades in different individuals. It ranges from a very light to a very dark and is always darker on the back. The under side is whitish. The muskrat lives in swamps, ponds and streams, and often burrows in the banks of the latter to construct its nest which is placed in a large chamber at the end of the burrow. While the chamber is always above the water level, the entrance may be beneath it. Muskrats also build large dome-shaped

huts two or three feet high and from five to six feet in diameter. These homes resembles, somewhat, those of the beaver. The houses are placed in the water away from the shore and are made of sticks and reeds. The interior of the house has a floor above the water level and is reached by diving from the outside. The muskrat does not hibernate but spends much of the winter within its house, although it frequently goes on its excursions when the ponds are frozen and I have even seen it swimming beneath the ice. It feeds upon water plants, crayfish, mussels and, occasionally, fish. It also stores up roots and other material for winter use and sometimes invades gardens where it feeds upon cultivated plants.

While the muskrat is chiefly nocturnal, it is often active during the day, and it may occasionally be seen sitting upon a stone or log, feeding.

The young are born naked and helpless and there may be from four to thirteen in a litter. Muskrat tracks may be seen in the grassy regions along ponds and streams where they have well-beaten trails. The front feet have four toes and the hind feet have five.

The creature has a total length of twenty-one inches and the tail is almost one-half as long as the head and body combined. The hind foot measures three and one-half inches and the creature may weigh as much as two and one-fourth pounds.

The Porcupine: Hedgehog

Erethizon dorsatum dorsatum

The porcupine is one of the most spectacular of our common mammals. The specialized development of many of the hairs into sharp spines or quills from

PORCUPINE *Erethizon dorsatum dorsatum*

a half-inch to three inches in length, make the defense a formidable one. When danger approaches the porcupine lowers its head, arches its back and appears to be rolled into a ball. The spines stand up and point in all directions and the tail is made ready for a vigorous sweep. When attacked, the tail strikes like a whip and the enemy receives a large collection of sharp penetrating needles. Since the spines or quills protect every portion of the body, its defense is almost impregnable.

The spines are not firmly attached in the skin and when their free ends penetrate the skin of a foe, they pull out and remain firmly imbedded in the victim, being held fast through the barbs at the tips. The porcupine does not "shoot" its quills as many people believe.

However, porcupines are not immune to all attacks and many of them fall victims to eagles, owls and wild cats. The porcupine is a solitary animal and is chiefly nocturnal in its habits. Being a true rodent, it is capable of doing considerable damage and it frequently gnaws through doors and wooded walls. Campers who carelessly leave their axes within reach often discover the handles gnawed the next morning. Most any wooded object that is handled by humans is subject to the workings of the porcupine. The creatures apparently do this for the salt left by perspiration.

The usual food of the animal is various in character. It devours most anything, and in its woodland haunts it feeds chiefly upon bark, twigs and fruits. It climbs trees readily. The porcupine is a sluggish animal and seldom attempts to make haste, depending upon its array of spines for protection.

The young, numbering from one to four, are born in May and are larger than the young of many mammals many times their size.

The favorite haunts of porcupines are evergreen forests, and they seem to prefer hemlock trees for food.

The Snow Shoe Rabbit or Varying Hare

Lepus americanus virginianus

This is a rather large species, attaining a length of 19 inches, and it gets its name from its large broad feet which seem well adapted to snow travel. The hind

VARYING HARE *Lepus americanus virginianus*
In Winter Dress.

feet are provided with long hairs which produce a snow shoe effect. In winter the creature is a snow white color, while in the summer it assumes a color varying from a grayish to a reddish brown. It is commonly supposed thatthe hairs turn color with approaching seasons, but it has been definitely established that the changes appear with moulting.

The varying hares are chiefly nocturnal in their habits and rest during the day in crudely made beds of grass or in depressions in snow. Their activities increase in the early spring when mating begins. Frequently, during the mating season a number of males congregate in the same place and indulge in bitter fights. When disturbed they thump the ground with their hind feet as do most members of this group,

probably to warn others of approaching danger. It is believed by some people that they call their mates in this way.

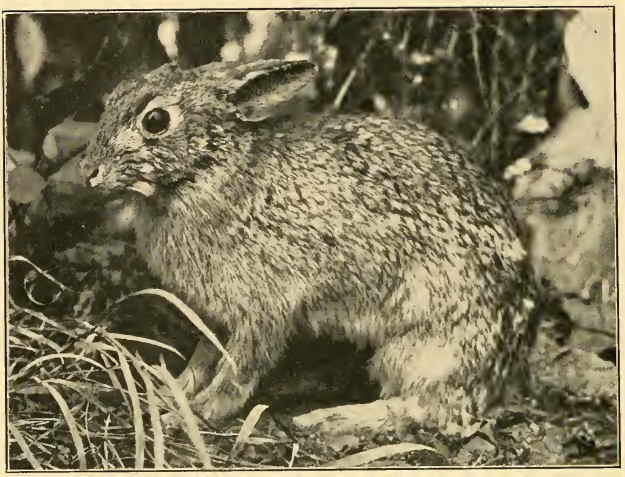
The species does not burrow into the ground but often makes depressions in which the young are placed. There are usually from three to seven young. The nests are made of dry leaves and grasses to which the mother adds a lining of hair from her own body. The nest is placed under brush or in dense vegetation. The food consists of grasses, small plants, twigs and buds. They do not hesitate to enter gardens but they are found only in the northern part of the State, although in severe winters they have been killed in Fayette and Westmoreland counties. It is seldom abundant. It is distinctly a northern species, although it abides in southern regions where it seldom assumes the full white color. A number of these more southern forms are subspecies. Its most common enemies are the weasels and snowy owls.

Rabbit: Cotton Tail

Sylvilagus floridanus mearnsii

The common "cotton tail" is familiar to every one. It is so abundant in Pennsylvania that it is often seen in city yards at night. Probably no other wild creature delights children as does the rabbit. It figures largely in their Easter celebrations, and every child has listened many times to Uncle Remus' tale of "Brer Rabbit," and to "Bye Baby Bunting."

Rabbits inhabit the woodlands and the open fields over which they roam chiefly at night. Hundreds are killed by automobiles on the roads each year and thousands are shot during the open season. But they persist



Cotton Tail Rabbit *Sylvilagus floridanus mearnsii*

in great numbers, sometimes becoming quite a serious menace to orchards, gardens and field crops. Their habits of chewing the bark from fruit trees in winter, and the destruction of alfalfa, vegetables, nursery stock, etc., make it necessary to keep them in check.

The rabbit may nest in an underground burrow or in a shallow depression in the ground. Ofttimes the mother will line the depression with grass, dead leaves, and hair taken from her own body. In this cozy nest several litters of from three to six young are born each year. The nest is covered so well that it is usually hard to find. As darkness approaches, the rabbit ventures forth on its foraging expeditions and it frequently becomes a victim of foxes, weasels and owls. Sometimes during the day it sits and sleeps under a bush or in a

"special set up" in deep grass. If disturbed, it scurries away in a zig-zag manner, its "cottony tail" showing conspicuously. Usually when danger approaches, the rabbit will thump the ground with its hind feet to warn others of approaching danger. The long hind legs are powerful and capable of rendering quite a kick. The rabbit differs from the hare in that it is smaller, has shorter ears and legs, and has a snowy white under tail.

There are two species of rabbits in Pennsylvania; both are quite similar in most respects, but the above described form is more southern in its distribution. The other species, *Sylvilagus floridanus transitionalis,* is generally found in the northern section of the Commonwealth.

White Tailed Deer

Odocoileus virginianus virginianus

The white tailed deer is one of the best testimonials that could be given in support of the State Game Commission. Not many years ago deer were so scarce in Pennsylvania that when one was seen, it received a prominent place in the news items. Today the deer abounds in the State and thousands are killed annually. In some places farmers are complaining of their numbers and insisting that the open season be extended.

The deer is certainly the swiftest and most graceful of the larger mammals. The long slender legs and lithe body make the creature beautiful to look at. The habit of raising the tail and showing the white under side in flight is considered to be a warning gesture to

Brown Bat

others in the vicinity, and has earned for it the name white tailed deer.

Only male deer have antlers and these are shed annually. As the young male grows the top of the skull develops two projections known as pedicles which serve as a base for the antlers. With the increase in size and thickness of the skull, the pedicles spread and do not protrude so prominently. As the animal grows older, the antlers develop as a soft pulpy mass covered with skin and fine velvet-like hair. When the full growth is reached the circulation of the blood is cut off and the antlers become hard and dry. The animal then removes the "velvet" by rubbing the antlers on young trees. This is usually done about the first of September. The size of the antlers depends at first on the age and physical condition of the buck, but later age

does not usually affect the size. There is no doubt that the food supply influences the growth.

At first the males are very careful of their antlers but later when the mating season arrives in October, the males will fight among themselves, often breaking their recently matured antlers. Sometimes they become inextricably interlocked and death results. The deer is usually about a year and a half old when its first set of antlers is mature. The first set, as a rule, does not have prongs or branches and it is called a "spike buck." In succeeding years, the number of branches increases and the best sets of antlers appear when the animal is about five years old.

The female deer or doe gives birth to one or two and rarely three young in the early part of May. The young are called fawns and are possessed of the spotted forest pattern which seems to render a protection. The young do not follow the mother for the first few weeks and, as they grow older, the hair coat develops in full, the spots gradually disappear until Fall when the coat of coarse hair is a uniform brown.

There are two pelage phases of our common deer. In summer its body is a reddish brown with the belly, under side, tip of tail, inside of legs and throat patch, white. There is a blackish spot on either side of the face and a whitish band across the nose. In winter the body color changes to a grayish or grayish brown. The hair also becomes longer and stiffer. The young are reddish brown with white spots that persist until the fifth month.

The deer is from five to six feet long and the tail measures twelve inches. Its height at the shoulders is

three feet and a mature male may weigh from 250 to 300 pounds. The older bucks have enlarged necks during the mating season.

The deer is a ruminant or browsing animal, feeding entirely upon vegetable matter such as the buds, leaves and tender twigs of trees and shrubs. In winter when food is scarce they will devour Rhododendron, laurel, hemlock and bark. In extreme cases, the deer will visit open fields and even mingle among domestic stock on rural farms. It is interesting to note that the deer can survive on plants which kill sheep and other animals.

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